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In this airship Mr. Vaniman hopes to cross the Atlantic in four days in the wake of a storm.

VANIMAN-SEIBERLING TRANSATLANTIC EXPEDITION—[See page 366.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Popular Science

IT was Huxley, we believe, who expressed the opinion that it was the duty of every scientific man to scatter among the multitude a few grains of that scientific knowledge which he has laboriously acquired by patient research. Huxley himself practiced what he preached; for he gave the world the most ably-written popular scientific essays in the language, essays which stand to-day not simply as admirable examples of scientific reasoning, but as almost classical examples of good literary English. Indeed, the whole group of Darwinian disciples seems to have been gifted with the rare ability of presenting the facts of evolution, so that the mass could understand them, and doing so without loss of dignity. Perhaps it was because the acceptance of the theories of evolution conflicting though these did with the accepted theories of creation, had come rather from the people than from scientific men, that the popular writers on evolution directed their appeals to the men and women who had no scientific knowledge and who had to be talked to in their own language. Certain it is that "The Origin of Species" could hardly have been written more simply and more lucidly than it is.

That science, when it is popularly expressed, need not be sensational, need lose nothing in accuracy of statement, and may be even artistic in expression, is evidenced by the written work of Sir Oliver Lodge, Sir William Crookes and Sir Norman Lockyer. English men of science, on the whole, are better literary men than Americans. In this country we find, frequently, obscurity and carelessness of expression which can only be explained by the lack of that literary atmosphere with which the names of Cambridge and Oxford are inevitably associated. It may be that our violently sensational press, which seizes upon the artificial germination of frogs' eggs and converts it into a double-page Sunday magazine "feature" that causes a real scientific man to writhe at its mere contemplation, has brought about this aloofness of the American scientist from popular science. In no country in the world is the thirst for knowledge so great as here. In no country are the people so willing to read articles on scientific subjects, if they are only expressed in an untechnical way. As we glance through even the popular scientific periodicals, we find them almost deliberately technical in expression. Sentences bristle with references to the "Huntingdon-Heberlein process," the "Kerr effect," and the like. Engineers are particularly given to this method of expression, which, however intelligible it may be to the scientist interested in that particular branch of research, is cryptic to the ordinary reader. What can the man in the street be expected to know of the X-Y-Z-type motor, and such terms?

There can be no doubt that coupled with an actual thirst for knowledge is the appeal of the miraculous. Unfortunately, it is the miraculous only that is exploited in the daily newspaper, and if the particular scientific discovery of the day is not sufficiently startling for journalistic purposes, the reporter will not hesitate to exaggerate, if it is merely for the purpose of astounding his readers. It cannot be denied that there is a romance in science, a poetic quality that can be legitimately expressed, and which is expressed by the best writers of the day. What, for example, can be more appealing than the thought of Caroline Herschel assisting her brother night after night in his astronomical work, even feeding him with her hands so that he might not be compelled to lose a single precious moment? What can be more dramatic than the fact that Newton, when at last he beheld the law of gravitation in his grasp, was unable to complete the simple calculation that inevitably proved the correctness of his views, so overpowering was the effect upon his imagination? What poet has ever soared to greater heights than Darwin and Spencer, men who reared upon the thousands of biological facts that picture of the evolution of all living matter that is epic in its magnitude? What can be more magical to the ordinary reader than the simple story of the coal tar dyes, that wonder working of the chemist which has converted what was once a noisome ooze of gas works, difficult to dispose of, into a palette of gorgeous colors, a medicine chest of precious healing unguents, an arsenal of explosives, a garden of roses? What man is so unemotional that he cannot be stirred by the recital of Edison's quest of a filament that would give him the light for which he was seeking, a quest during which men slept in his laboratory with resistance boxes for pillows and work benches for beds?

In a paper read last year before the section of Physiology and Experimental Medicine of the American Association for the Advancement of Science, Prof. Charles Sedgwick Minot speaks of technical articles which are "bungled in form and weakened by prolixity." It is his opinion that the heads of laboratories should insist, by example and precept, that all the workers under their influence, should write clearly and briefly. "For if an author fails to show respect for his own scientific work, how can he expect others to respect it?" Surely there can be no better way of intensifying the world's respect for science than by using the English language for the dissemination of knowledge in a dignified and yet simple way.

Popular scientific writing, in its best sense, by which is meant simplified and not sensational science, implies nothing that a really scientific man would not care to undertake. It is all a matter of expression, of writing down to the level of the multitude—not necessarily speaking the language of the street, but at least appealing to the brain of the street. It is writing such as this which has proved a source of inspiration to many a man who has later graced the laboratory and the observatory.

Aircraft in the Recent German Maneuvers

AS in France, so in Germany, aircraft have been employed in the army maneuvers this year for the first time in real earnest—not as an experiment, but as a legitimate branch of the regular service. This feature was emphasized even more in Germany than in France, because no civilian aviators in disguise were employed, but only the official military pilots; all officers trained at the military flying grounds in machines belonging to the army.

As it happened, these maneuvers demonstrated principally that, for military purposes, the shortcomings of to-day's aircraft count for less than elsewhere; for the weather was very propitious during the more important military operations. Aeronautics is evidently sufficiently revolutionary in warfare; this existence simply means that fair, quiet weather at any moment entirely reverses the situation as it may have developed while stormy winds prevailed.

In this year's maneuvers Count von der Golz, the Commander of the "blues," had at his disposal the older but entirely reconstructed Gross-Basenach airship "M II." and four biplanes, all of the German Albatross-Farman type. All these aircraft flew a blue-white flag, and the "MII." had a new envelope of silver-gray aluminium-rubber cloth, which, without being heavier, is much more gas-tight and weatherproof than ordinary yellow rubber cloth. The red army air squadron, at the disposal of Prince Friedrich Leopold, flew a white-red flag and consisted of the fast "M III." Gross-Basenach dirigible and four "Taube" monoplanes. The "M III." still had its old yellow envelope, which in the end caused its destruction by fire through its being an absolute non-conductor of electricity.

The homogeneous nature of each of the opposing airfleets also tends to give these German air maneuvers a more military and businesslike aspect than the French ones displayed. Each of the eight aeroplanes carried two men, a pilot and an observer, the very bird-like Etrich-Rumpler monoplanes being just as good passenger machines as biplanes. It will be seen that the red side had the faster craft. Each side organized an aeronautic field-park, consisting of one great "regulation" transportable airship tent (100 meters long), and four aeroplane tents. The former are very strong. They consist of a skeleton of steel masts and cables, covered with stout canvas. It takes twenty-four hours to pitch such a tent and half as long to break it up. The aeroplane tents could be pitched and struck in a very short time. They were transported, each on two automobile trucks. So it became possible that Lieut. Machenthun flew at dusk to the farmost line of outposts, and later, in the darkness, his tent was taken there too on its automobile train. He camped all night close to the enemy and at daybreak ascended and flew directly across the hostile position, while the automobiles "took flight" with the struck tent toward safety in the rear. Having but little distance to cover in reaching the enemy, Lieut. Machenthun thus, after very little time, was able to return with information of vital importance.

The most striking work of the aeroplane, however, was done on the red side. The military situation was such that the red army attacked at once in force, while the blue one was as yet scattered and showed a very weak front. An elaborate ruse was then resorted to, to "bluff" the reds. An officer of the general staff, pretending to carry a message on horseback to one of the blue commanders, allowed himself to be chased by red cavalry, and while in flight deliberately dropped a map with bogus positions showing great forces of the blues (who actually were still far away) marked upon it. The chart was recovered by the reds and in due course reached their commander-in-chief, who was much pleased with such a piece of booty, especially as cavalry scouts reported that the marked positions really existed. The reds were presently massed against empty ditches containing small heaps of stone and earth, which, from a distance, appeared to the scouting cavalry as the yellowish-gray, helmet-covers of infantry prone on the ground, while positions actually threatened were denuded of troops. To make doubly sure, Lieut. Canter's monoplane was sent flying over to the enemy's charted positions. His observer (long trained aboard captive balloons) had hardly passed the hostile advance posts, when he discovered the true nature of that first line of bogus positions. Instead of returning, the officers first continued their flight until they had found that the second line was a mask as well as the first, that the reserves were not where they had been marked on the captured chart, and that the only real strength at that front was strong bodies of artillery. But the time now had become pressing, and it was of the utmost importance that the red commander should be informed of his error at once. Lieut. Canter did not have to fly far in a search for the red headquarters. He spied the black-and-yellow flag marking the position of the Emperor himself, and with quick decision he laid his course for it, came close to the ground and had his observer drop a card with the news right before the feet of the Emperor. The reds then won, and later, at the criticism that always follows operations, the Emperor asked for Lieut. Canter, shook his hand and thanked him personally. In his final criticism the Emperor dwelt especially on the excellent services rendered by the dirigibles and aeroplanes, which proved to be the decisive factor in these maneuvers. It was observed that the fast dirigible "M III." employed peculiar well developed tactics in dodging artillery fire by sudden changes in the level and direction of its flight. On both sides the dirigibles were in action all day long.

Horses Hold Their Own in France.

NOTWITHSTANDING the fact that the development of the automobile, as well as of the aeroplane, has proceeded more rapidly in France than in any other country, the use of horses seems to persist there better than in some of the slower-moving nations.

In ten years the number of horses in Paris has diminished by 24,210—that is, from 96,698 in 1901 to 72,488 in 1911. This large decrease (a trifle over 25 per cent) makes the increase for the country as a whole all the more striking. In Paris mechanical traction has displaced the horse on all the omnibus lines, and the horse-cab is rapidly disappearing.

The persistence of the horse in rural France is attributed to the fact that there, in contrast with England and Germany, for example, the land is divided into very small holdings, so that the farmers are for the most part quite unable to afford an investment in mechanical appliances for traction, etc., notwithstanding the greater eventual economy in using motors in place of horses. It is expected that the farmers' associations will be able to devise some co-operative plans that will give the small farmer access to the advantages of modern inventions along this line.

Frank Julian Sprague

Inventor and Engineer

By Thomas Commerford Martin

THE career of a great inventor and engineer like Frank J. Sprague, graduate of the Naval Academy and successful pioneer in the modern art of electric traction, stands out with peculiar distinction. There may be, or may have been, notable sons of Neptune in other fields, but in the electrical he has certainly few rivals from the sea; and in the department of electric traction none. This is hardly to be wondered at, for it is a curious twist of fortune that takes a man from the trackless deep and sets him laying track all over the face of every continent.

On May 16th, Mr. Sprague received from the American Institute of Electrical Engineers the Edison gold medal—its second award—for his achievements in traction, horizontal and vertical; and in accepting this new and rare honor, he remarked that the reason why he won it was that Edison had refused to keep him as an assistant in the early days of electric lighting. The picturesque details will be noted a little later. The point to be made here is that the cause or reason is not carried back far enough to be altogether adequate. The fact is that when Sprague left the navy, there was no navy to leave. The result was a general exodus carrying into electricity such men who have made their mark in it as Sprague, Greene, Duncan, Weaver, Shallenberger, and many another. Had they had the new ships to command they would all have stuck to the ship, Sprague included; and someone else among them would now be the rulers of Taft's navy. There would have been plenty of room for all their electrical engineering in the application and use of the modern diversified electrical equipment. The advocates of peace and of a small navy ought not to lose this opportunity of showing, as they can irrefutably, that the absence of a fleet was the main cause of giving the world its useful trolley system. Another cause, going just a little farther back, was that Mr. Sprague was born in Connecticut.

Winning entrance to the Naval Academy in a competitive examination, and graduating in 1878, Mr. Sprague was already electrical in his tastes and aptitudes. Even then he was inventing, and made a special trip to show Edison a new wrinkle in telephony. Menlo Park was doing quite a little business of its own in telephonic invention, the details of which when brought to Mr. Sprague's notice convinced him that he would have to get up rather earlier to catch the worms. Nothing daunted—for every aspiring youth in those days invented a telephone—he took up gladly the duties of his profession, and sailed for the Far East on the old U. S. S. "Richmond." While serving on the Asiatic squadron he acted as the special correspondent of the Boston *Herald* in recording the travels of General Grant and the wonderful reception given the old soldier in the Orient. This was congenial occupation to a man gifted with unusual powers of observation and expression—but the note books not used up in this fashion were devoted to data of all kinds of electrical theory and invention. The present writer has seen some of them and realizes what a nuisance Sprague must have been to his messmates. It may have been due to their intervention that he was shifted to the training ship "Minnesota," where his didactic qualities had full play. His next appointments were to the navy yards of Brooklyn and Newport. Farmer, the electrician, was doing his notable work for the torpedo station at Newport, and no one could come within touch of that noble spirit without being stimulated to thought and invention.

Mr. Sprague was greatly impressed with the possibilities of electric lighting, and at a time when no naval ship anywhere had the incandescent lamp, proposed to get away from the old methods so disagreeable and dangerous. He asked Edison for the loan of one of those long-waisted "Z" dynamos, prototype of the modern skyscraper, but when he said that it was to be hitched to an antique single-cylinder flywheel pump, Edison demurred. The irregularity of the pump engine might have made Sprague the inventor of the Ardois signaling system, but Edison had an intense aversion to seeing his lamps flicker. Sprague let himself loose on new arc lamps, continuous current machines without commutators, and a double wound armature with internal field, the several circuits being connected to a field to give various series and parallel combinations. He was slowly finding himself. That there was real inventive ability developing in the man is evident from the fact that in 1881, watching the action of a large Ruhmkorff induction coil, he suggested connecting the high tension coil to a balloon and the ground, and in case of discharge to get larger currents of low potential from the primary without using the circuit breakers. Had he been master enough of his technique to "follow through" Sprague could easily have hit then upon the transformer.

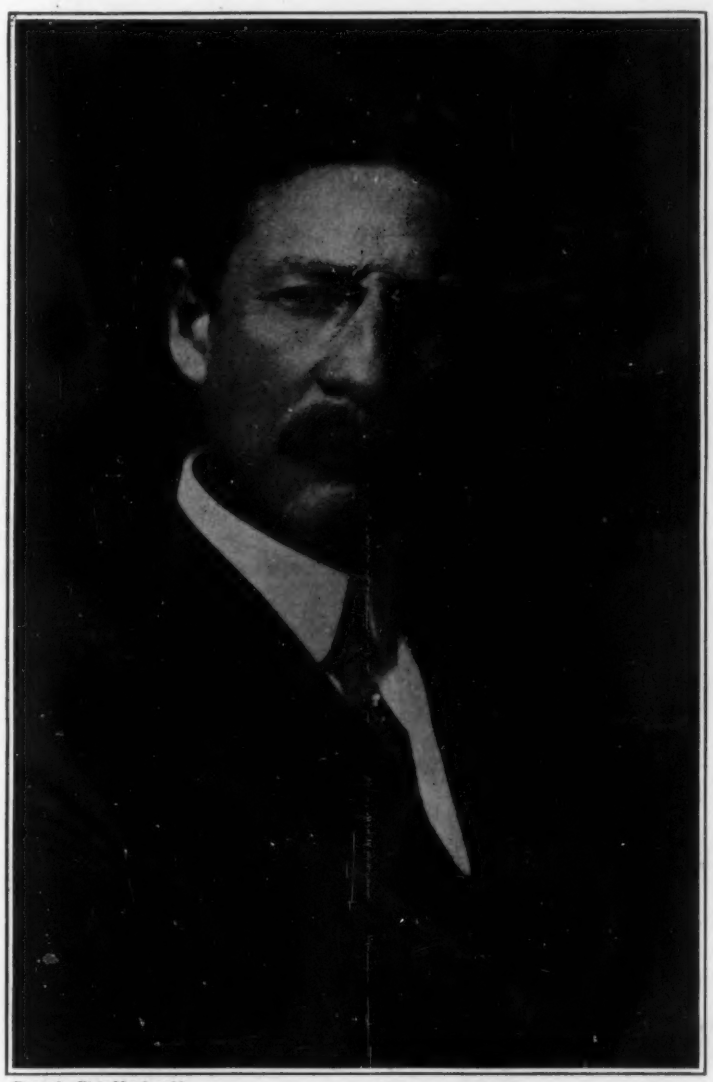


Photo by Pirie Macdonald.

FRANK JULIAN SPRAGUE

Then came the memorable Paris Electrical Exposition of 1881, and Sprague was crazy to get there. He secured a detail to the U. S. S. "Lancaster," bound for the Mediterranean as flagship, with leave at his own expense on his arrival abroad. This in itself was an invention. The exhibition was closed, however, when the "Lancaster" passed the Pillars of Hercules; but as there was another electrical show in 1882, at the Crystal Palace, near London, young Sprague, by sheer nerve and audacity, got his leave extended, and landed in England with $20, an unnecessarily large sum for one so resourceful. Taking up his work in connection with the exhibition—a landmark in English electrical history—he was made a member of the jury of awards, and at his own request was attached to the dynamo electric machinery section. The section made him its secretary. Here he was at once in his element, meeting the great men of the day, revelling in the study of apparatus, and free to ask any question that occurred to his preternaturally inquisitive mind. In the midst of this delicious "joy ride," Sprague was peremptorily ordered to rejoin his ship at Naples, but though scared at the idea of a court martial, he begged off, once more got leave, made a splendid report to the Navy Department on the exhibition and never went back. That report is one of the very scarce electrical "treasure trove," and at once stamped Sprague as an engineer of quality. In London Mr. Sprague—barely an ensign yet—met Mr. E. M. Johnson. "There is but one Edison and Johnson is his prophet," said an English journal with equal truth and flippancy; and Johnson has always had a keen eye for talent. He took kindly to young Sprague and sent him across the Atlantic to Edison, just as he did that other distinguished leader, Samuel Insull. This was May, 1883, and Sprague was ordered off to help in the construction at Sunbury, Pa., of the first overhead three-wire system of incandescent lighting. That job was soon followed up by his being put in charge of the first three-wire underground station at Brockton, Mass. There Sprague made calculations for the distribution network of other Edison central stations then going on rapidly, but he regarded it as almost an impertinence to be bothered about them, for he was working out his first electric motor. Here was the parting of the ways. Edison has always wanted associates who were all his own, on whom his dominating personality could be impressed, who would help carry out his prolific ideas and not incidental inventions of theirs. When Edison invited him to take up the subject of electric power transmission as an adjunct to Edison stations, Sprague replied airily and haughtily that he, too, had given a little thought to that, and meant to work it out from a personal point of view. Needless to say, Sprague was invited promptly to resign. With equal promptitude he did; organized his own motor company, and in 1884, at the first American electrical exhibition in Philadelphia, made an enormous sensation by the exhibition of his new motors. They not only gave a tremendous stimulus to central station development, as a source of supply of electrical energy, but set going a furore as to electric traction. Sprague stationary motors for industrial power are in use to this day; but for the inventor the possibilities of the field were soon worked out, and he threw himself with redoubled energy on the big problem of transportation, to which his thoughts had been directed ever since 1882.

The year 1887 marks an epoch in electric traction throughout the world. Sprague's first real street railway was that for St. Joseph, Mo., but the vital point was reached when he took with confidence and even a light heart the contract to equip and operate a new system at Richmond, Va., with no fewer than forty cars. All was crude but the goal had been reached, and with one great, mighty leap, the trolley came into its own.

Meantime the Sprague interests had been consolidated into those of the Edison General Electric and the General Electric Company, with undoubted benefit to the public and the art, but leaving Sprague outside the breastworks. They do say that his name was chipped off the castings. The writer has never seen any evidence of such mutilation, but even if true it didn't make any difference; for Sprague was not chipped a bit. On the contrary, he bobbed up serenely with a brand new system of electric elevators, and having tackled grades of 15 per cent blithely, now dealt deftly with those of 100 per cent. Here Mr.

(Continued on page 377.)

New York's Fire College

Fire-fighting and Rescue Work Reduced to a Science

By Herbert T. Wade

FOR many years the New York Fire Department has maintained a training school for firemen where practical instruction was given to those who had passed the civil service tests and had been appointed for a probationary period of one month. This training school not only was indispensable for the New York Fire Department, but served as a model for those of many other cities. To-day the need of thoroughly trained firemen is greater than ever, and their education can not be confined to such rudiments and essentials as may be taught to the probationer, but in addition must involve systematic instruction all along the line up to and including the officers in command of companies and battalions.

In efforts made recently to raise even higher the standards of the New York Fire Department there has been established a Fire College which includes not only the various schools previously maintained by the department, but aims to extend and systematize the instruction in practical fire-fighting, especially in the use of motor apparatus and other modern appliances now so extensively employed. This instruction is given by the best qualified men in the department and promotions to higher grades so far as is practicable are made only from those who have satisfactorily completed the appointed courses.

The chief of the department is the head of the Fire College Board, and the college itself is composed of a probationary firemen's school, engineers' school, officers' school, company school, and a special class in automobile operation. The first of these to be organized was the Probationary Firemen's School, at which all the probationary firemen are required to attend for at least thirty days after their appointment and before they are regularly accepted and permanently detailed to companies. The instruction here as the illustrations show is exclusively practical, being based upon that formerly in vogue in the training school, but amplified as regards its amount and in the apparatus used. The practical work takes place in the rear of Fire Headquarters, where the probationers are marshaled with their scaling ladders of hardwood surmounted by a toothed hook and containing cross pieces up which a fireman may climb after the hook driven through a pane of glass perhaps is firmly placed on a window sill above. A number of scaling ladders in the hands of the firemen trained to their use affords a ready means of climbing up the side of a building and of passing from window to window. The probationers are taught not only the use of the scaling ladder, but to climb ladders of all forms used in fire fighting, to raise and lower them, to straddle and stand on window sills, holding perhaps a companion in search of a point of vantage, or passing along some inmate of the house who has been overcome by smoke.

The large ladders, some of them 50 feet in length and carried on the hook and ladder trucks, also are used in the school, and the life saving rope which is shot up to the roof by means of a gun and shot line. The firemen are taught to haul up hose and ladders by a rope and to lower persons to points of safety when stairways and fire escapes are cut off by the flames or smoke. This means that the firemen must know the various knots employed and the method of using the gun. Then there is the use of the life net, for perhaps no one is left on the roof to lower the fireman and he must learn to jump properly into the net held by his comrades. They, too, must know how to hold the net properly. All of this involves careful training for the muscular men who already have passed a severe physical test, and day after day they raise ladders, climb up and down them to the top of the six stories of Fire Headquarters until they become expert. Then also they must learn the use of the hooks and axes for getting directly at the seat of a fire and removing smoldering wood, the use of picks, battering rams, crowbars, mauls, door openers, lock openers, tin roof cutters, wire cutters, and pinch cutters, all to get into a building or directly at the flames, for a fire may occur at night when a building is tightly locked. Furthermore there are the ordinary connections of hose; to make them speedily is one of the first duties of the fireman, and he must understand the making of siamese connections, taking a line from engine or high pressure hydrant to a standpipe, carrying hose into buildings, and up ladders, connecting with a cellar pipe, and finally the use of hose within tall buildings where the building pumps or the city high pressure may force water far above the limits of the fire-engine in the street below. The high pressure now used in the lower parts of New York city presents many problems and dangers for the hosemen, and this is a modern feature which the new system of instruction aims to make clear. The construction and use of the large special hydrants and reducing valves is demonstrated and the method of connecting hose thereto and the use of the nozzle holder are explained. There is also instruction in the use of the fire alarm telegraph system so that various alarms, ambulance calls, and other signals can be sent, and finally the Fire Department surgeons give an elemental but practical course in first aid to the injured.

Teaching the firemen how to stretch and connect hose and the use of nozzle-holders with high-pressure streams. A three-way connection with cut-off valves is shown in the foreground.

Using the cellar pipe. The platform represents a ground floor through which a hole has been chopped in order to get at a cellar fire with a hose stream.

The play-pipe or deluge set. Used for a powerful stream when vast quantities of water must be poured into a burning building.

NEW YORK'S FIRE COLLEGE

Interesting and important as this work is, it is perhaps exceeded in actual usefulness so far as the New York Department is concerned by other schools for the engineers and higher officers. Thus in the past there has been criticism of the engineers of the fire department that in some cases they did not keep their engines at a high degree of efficiency, and in actual operation they did not get the results that a more intimate and intelligent knowledge of the machinery would have secured. Accordingly a few years ago an Engineers' School was started with beneficial results, and this was made a part of the Fire College with a more extended course and competent instructors. In the high pressure districts the engineer of a company is stationed at the hydrant watching the control and reducing valves, while with the extensive introduction of motor apparatus now in progress he will be concerned with the care and operation of the gasoline engines. In the first place all engineers are required to attend this school, which is open also to first and second grade firemen upon approved application.

Hereafter only graduates of the school will be appointed as engineers. The practical work is being done in one of the machine shops of the department and consists of an extended course in engines and boilers and gasoline motor engineering. Here the engineers and firemen desirous of promotion study the actual machines and their construction and operation.

For many of the engineers, not to mention the firemen, gasoline motors have been a sealed book, but under the administration of Commissioner Johnson much motor apparatus is being added to the New York Fire Department and eventually the entire department will be on a motor basis, so the importance of the work is evident. In fact so immediate is the demand for properly qualified chauffeurs belonging to the uniformed force and men competent to operate and repair gasoline

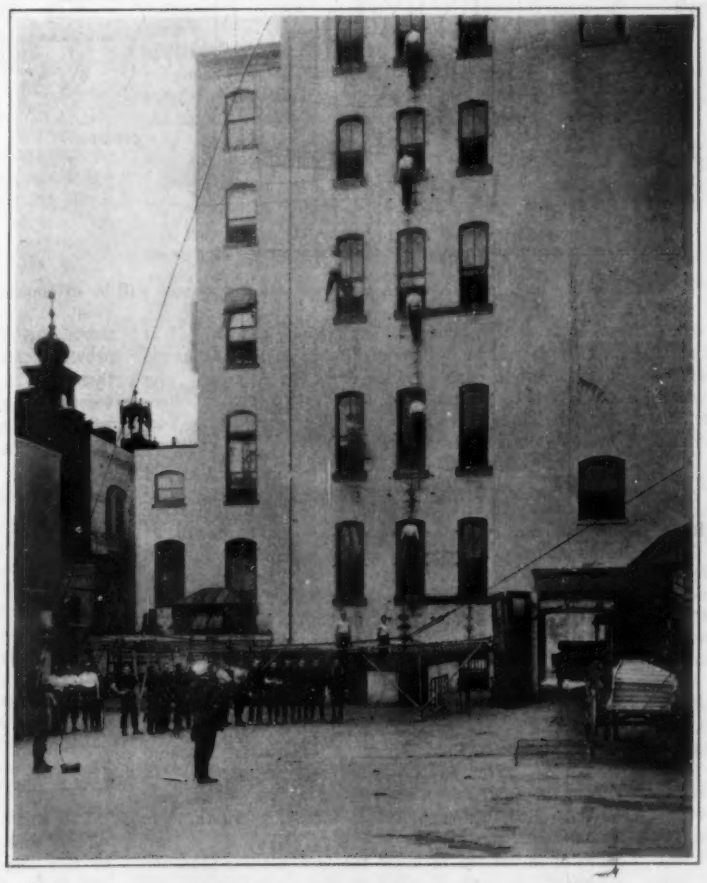
engines, that there has been established a special class at the repair shops of the department for the training of such firemen. Here the men are taught the practical operation of motor apparatus so that competent chauffeurs will be forthcoming as the horse-drawn apparatus is displaced. This is taking place as rapidly as possible, and by the end of the year the New York Fire Department will have a number of distinct and separate types of motor-drawn machines in use.

The Officers' School affords a means of raising the general technical standard by having those who have evolved certain practical methods teach them to others, and give general information as to conditions and methods in different parts of the city. Thus chiefs and company commanders in the high pressure districts have learned to use this new weapon most effectively and gradually are standardizing the different practices. These must be taught not only to those serving in the protected territory but to others who may be called there either individually or with their companies in the event of a large fire. In other words, certain chiefs and firemen have acquired special skill in dealing with certain conditions, and it is the intention that such methods should be taught to every officer.

For the company school entire companies are ordered to Fire Headquarters and are instructed and drilled in the effective use of the apparatus.

The entire Fire College is intensely practical in its spirit, and its object of raising the general standard of fire work in New York city doubtless will be attained. With the practical work thus brought up to an even higher degree of excellence, it is likely that problems of construction and engineering eventually will be undertaken and the technical and professional knowledge of the firemen be correspondingly broadened, but to-day it is realized that efficiency alone is the keynote and this can be realized only through training and discipline.

The life net. Firemen being trained to jump into a net held by their comrades.



Drilling the probationers. The firemen are taught the use of scaling ladders and ropes for life-saving. The life gun and shot line to haul up a rope is the last chance for a fireman cut off by flames or smoke.

NEW YORK'S FIRE COLLEGE

Wireless Detectors

By Adelbert J. Gogel

ELECTRIC wave detectors, the most delicate part of the wireless receiving set, are the subject of much argument as to their relative sensitiveness and relative merits. There are a number of different types known, which may be arranged as follows in order of merit, according to most authorities:

(1) Electrolytic; (2) Peroxide of Lead; (3) Perikon (Chalco-pyrites and zincite); (4) Ferron (Iron pyrites); (5) Silicon; (6) Molybdenite (Molybdenum Disulphide); (7) Galena (Lead Sulphide); (8) Carborundum (Artificial Silicon Carbide).

The Electrolytic Detector, perhaps the most widely known type, appears in many forms, the most frequently used of which is that in which the point of a very fine silver plated platinum wire, about 0.001 millimeter in diameter, called a Wollaston wire, is immersed in a nitric acid solution contained in a small graphite-carbon cup. It is necessary to use a battery and a non-inductive rheostat capable of very fine adjustment, called a potentiometer, in connection with this detector. The battery polarizes the electrolytic cell, that is, the fine platinum wire is covered with tiny bubbles of oxygen and then the resistance rises so high that the current is nearly reduced to zero. If then an electric wave fall on the aerial connected to the electrolytic detector, it suddenly reduces the resistance of the cell. A telephone receiver of great sensitiveness being connected in series with the cell and potentiometer, sound signals can be heard in the telephone. For general and long distance work, this detector cannot be excelled except in localities where high powered interference is very frequent, which causes the platinum wire to be dissolved very rapidly and a detector working on different principles must be substituted. Substitutes will be mentioned later. The Lead Peroxide Detector consists essentially of a pellet of lead peroxide clamped between two surfaces, one of lead and one of platinum. A battery, potentiometer and telephone receiver are connected with the detector in the same manner as with the electrolytic detector. The lead peroxide detector works on a new principle; although no acids or liquids of any kind are employed, its action is electrolytic. When lead peroxide, lead and platinum are brought in contact as described, it has long been known that lead will be deposited on the platinum surface. When a battery is connected up properly with the detector, it opposes this action and causes the lead to be deposited upon the lead surface. When an electric wave falls upon the wires connected with the detector, a sound in the telephone is heard because of the change of resistance brought about by the passing of a wave. The Perikon Detector contact is between crystals of chalco-pyrites and zincite; in the Ferron Detector between a crystal of iron pyrites and a metal point; in the Silicon Detector between the element silicon and a wire; in the Molybdenite Detector between a crystal of molybdenum disulphide and a metallic surface; in the Galena detector between a crystal of lead sulphide and a very fine wire; in the Carborundum Detector between a crystal of carborundum or silicon carbide and a metallic surface.

The Silicon Detector retains its adjustment even when very near to a very high powered sending apparatus, and is therefore to be recommended where interference is very severe. If a piece of 99/100 per cent pure silicon can be procured, nothing better can be desired.

The Carborundum Detector, even though subjected to somewhat severe blows, often retains its adjustment for months at a time, which causes it to be the favorite detector with the amateur. However, it requires the use of a battery and potentiometer for its efficient use in long distance work. The green crystals are more sensitive than the blue or purple ones. The side of the crystal connected to the ground should be covered with tin foil or soldered in a cup.

A New York firm has put on the market a promising new detector for which broad claims are made. This detector is of the vacuum bulb type and very similar to the "Audion" of Dr. Lee De Forest, which is not within the reach of the average experimentalist owing to its high cost. This detector consists of an electric light filament, a grid and a plate sealed in a highly exhausted bulb. A battery to light the filament and another battery and a rheostat capable of very fine adjustment are necessary for the operation of this detector. When the current to light the filament is turned on, the detector is ready for business, requiring no adjustments of crystals and points or Wollaston wire and acid. This detector can be used to receive from all systems of transmission; singing spark, quenched spark, arc sets, telephone sets, in fact it will detect any wireless wave from whatever source it is produced. The makers of this detector claim it to be more sensitive than the electrolytic, which will be a decided advance in wireless receiving apparatus.

The wireless operator should not content himself with one detector, but should have several ready for use and a switch with which to connect up the desired one.

A device of some kind should be used to ascertain whether or not the detector of a wireless set is in a receptive condition. Several devices of this class are quite well known, but a short description will not be amiss. If a key sounder and battery are connected up near the detector, a sound is heard in the detector when the key is raised, if the detector is in working order. This method requires the constant operation of the key during the test or search for a sensitive area. But the author has found that if an ordinary electric bell with the gong removed, or a buzzer, is connected with a switch and battery, and two or three feet of copper wire be connected to the interpreter, the arrangement is much more convenient and efficient. The short length of wire acts as an antenna, and owing to the speed of the vibrator, a continuous musical note is heard in the receiver when the detector is working properly.

A variable condenser of good capacity should be shunted around the detector, enabling weak signals to be strengthened or cut out as desired. While transmitting, the detector should be short circuited by a switch to prevent its being burned out, or the wire in the telephone fused.

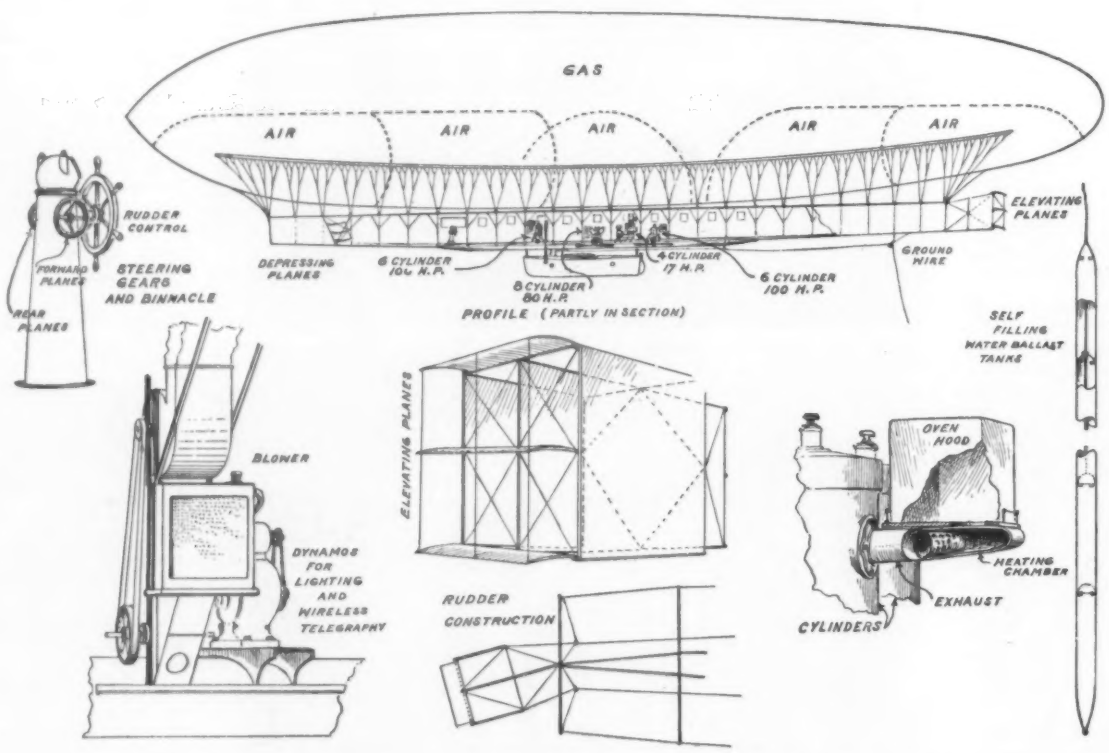
When not in use, the detector should be protected from dust and moisture. The crystals of the thermo-electric type of detector should be touched with the hands as little as possible, for the oil secreted from the skin causes a marked decrease in the sensitiveness.

Vaniman-Seiberling Transatlantic Expedition

Preparing for the Second Attempt to Cross the Ocean by Airship

IT was with no feeling of regret that Mr. Melvin Vaniman, leaning over the taffrail of the steamship "Trent," watched the ill-fated airship "America" sink slowly to the sea. One might suppose that the engineer who had spent so many years of work on this dirigible would entertain some sentimental regard for the old balloon. But Mr. Vaniman's thoughts were on another expedition, in which he would not be hampered with old material, an old gas bag, and old engines, but could plan an entirely new airship made of brand new material exactly as he wanted it. The "America" had served her purpose well, and from her in the years that had passed Mr. Vaniman had learned the lessons that were necessary to make a future ship successful. The design of this new airship was already beginning to take form in his mind, and after a short rest he was eager to begin the work again along new lines.

When the "America" was abandoned it was structurally sound, showing that the principles involved were correct. One part only had failed; a key worked loose in one of the propellers, and to this defect Mr. Vaniman attributed the failure of the expedition, as was pointed out in the SCIENTIFIC AMERICAN of October 29th, 1910. The propeller was one of a pair that could be revolved with their axes so as to exert a thrust at any desired angle. Had he been able to use this pair of propellers to lift the machine bodily upward by power, he could have raised his equilibrator out of the water and prevented that terrifying and nerve-racking surging of the airship caused by the drag of the equilibrator in the waves during the storm. Contrary to public opinion, Mr. Vaniman's faith in the equilibrator, or its equivalent, was not shaken, of enabling the "America" to beat all records for dirigible balloons as to time in the air, distance traveled, and weight carried. Its action in the sea, its defects and good qualities were all known after this voyage, and it was from this experience that Mr. Vaniman got to the heart of the problem, viz., the designing of a device that would serve the purpose of the old equilibrator and not have its defects, a device that would have a changeable weight, not a fixed weight; in other words, an equilibrator that could be made heavy or light at will.



Some novel details of the airship with which the transatlantic voyage will be attempted.

Principal Features of the Construction.

Early this summer Mr. Vaniman succeeded in interesting Mr. F. A. Seiberling, president of the Goodyear Tire & Rubber Co., of Akron, Ohio, who agreed to furnish the necessary capital. The construction of the gas bag was immediately started at the Goodyear plant and it was shipped to Atlantic City early in September. The gas bag was built according to Mr. Vaniman's directions, and differs considerably from that of the "America." The "Akron," as the new airship is called, is longer but of smaller diameter, and tapers gracefully toward the stern. The old hangar of the last year's expedition is being used by Mr. Vaniman, and to use this shed without enlargement it was found necessary to cut out 10 feet from the envelope as originally designed. The present length of the gas bag, therefore, is two hundred and fifty-eight feet, while its diameter is forty-seven feet.

Below the airship runs a car similar in shape to that of the "America," but, in the present instance, considerably longer. The body of the car is a steel tank forming a reservoir for five tons of gasoline. On this tank a platform is built, which is the deck of the airship. To drive the airship three engines are provided. One forward, of 100 horse-power rating, is fitted with propellers that rotate only in the vertical plane. The next two engines, of 100 and 80 horse-power, respectively, drive the propellers whose plane of rotation may be turned to any desired angle. Normally, only the forward engine will be used to drive the airship ahead, and it should give the craft a speed of about 30 miles per hour. About 60 pounds of gasoline will be consumed per hour, so that the supply of gasoline should last about a week. The propellers of the other two engines will be feathered, or turned to horizontal position, so as to offer no resistance to the forward propulsion of the vessel. In addition to these engines, there is a 17 horse-power engine directly connected with a dynamo, which will generate current for lighting the airship at night and for operating the Marconi wireless telegraph apparatus. This engine will also operate a blower with which the ballonets of the gas bag may be filled. Furthermore, it will drive a pump countershaft with which any one of the large engines may be started.

Substitute for the Equilibrator.

"If we can only keep down," said Mr. Vaniman in a recent interview, "our problem will be solved." It is an easy matter to design an airship to lift the necessary weight to enable one to cross the Atlantic. The difficulty is to maintain the airship at a constant moderate elevation above the water. The equilibrator performed this office last year. This year Mr. Vaniman expects to control the height of the airship mainly by taking on water ballast, and also by using stabilizing planes fore and aft. In case of emergency the elevating and depressing engines can be used. There will be three planes on each side of the car, at the forward end, which, as indicated in our front page illustration and also in the accompanying sketch, are curved upward, while those at the rear, mounted on the rudder, are reversely curved. These planes may be tilted to any angle desired, and will serve to keep the car on an even keel. When dipping down to take up water ballast, the forward planes will be used for depressing the bow and the rear planes for elevating the stern. These planes may be controlled separately by handwheels at each side of the binnacle, as indicated in one of the sketches. The level of the vessel may also be controlled to a considerable extent by inflating the ballonets forward at the expense of those to the rear, when it is desired to make the bow heavier than the stern, and *vice versa*, when it is desired to make the stern heavier.

To scoop up water ballast, it will be necessary to drive the balloon down near the level of the sea, which may be done by tilting either pair of the adjustable propellers to the proper angle. The only object in having two sets of adjustable propellers is to have a reserve pair in case of accident. The device with which the water ballast will be taken up is similar to the equilibrator used last year. It consists of tanks about 6 inches in diameter and 24 inches long, strung upon cables exactly as were the gasoline tanks of the equilibrator. These water ballast tanks will be provided with openings near the upper end of each, so that by dragging them in the sea they may scoop up water. There will be three sets of tanks strung on separate cables, and under normal conditions they will not hang from the car, as did the equilibrator, but will be stored in the body of the vessel.

When taking up the water for ballast, if the wind is strong, the airship will be headed into the wind and the tanks will be trailed from a point aft of amidships, so that there will be no tendency for the airship to nose downward into the sea.

It is planned to maintain the airship at an elevation of between 200 and 1,000 feet at the outset of the voyage, but as the airship is lightened by the consumption of gasoline and the provisions, the airship may rise to much greater heights. During the daytime it will have to be heavily water-ballasted in order to hold it down when the gas in the balloon is expanded by the heat of the sun. At night this ballast will be poured out to compensate for the contraction and consequent reduced lifting capacity of the balloon.

Suspended below the car will be the lifeboat in which the crew of the "America" made their escape. This will be materially changed to facilitate launching and for the comfort of the crew. There will be no well in the center, because there will be no equilibrator to pass down through it. In this boat the wireless telegraph apparatus will be stored. A much more powerful equipment will be provided this year, with a range of 500 miles, so that there will be little difficulty in keeping in touch with vessels along the course. To provide a ground, a wire will extend to the stern of the vessel, and thence trail in the sea, as indicated in the front page illustration.

The Crew.

The crew of this expedition will consist of the commander, navigator and helmsman, a wireless operator, two engineers to keep constant watch over the engines, and one extra man for general work.

Provisions will be carried for a cruise of twenty days. An ingenious cooking stove has been provided. Last year, when at the close of the first day it began to grow dark, Mr. Vaniman was astonished to find that the exhaust pipe of his engine was red hot and expelling streams of sparks that were invisible by day. This year he has made a cook-stove on the exhaust, as shown in one of the sketches, and will utilize the heat for cooking.

On the Wings of a Storm.

The construction of the airship is proceeding very rapidly and will probably be completed by the end of this month. Thereafter, two or three trial trips will be made, and then, when weather conditions are favorable, the expedition will be launched. Mr. Vaniman expects to make good use of the storms that travel across the Atlantic to carry him over. It will be recalled that last year a storm was encountered which carried the airship along at such speed that

it had to drift broadside to the wind, owing to the drag of the equilibrator. This storm with the aid of the motors took the airship to a point near Nova Scotia, but then vanished, and a second storm which had been forming over Cuban waters for three days began to affect the airship, although 1,200 miles away. The wind flowing toward the storm center was so strong that the motors could not be used, and the airship was taken southward out of its course. Had the "America" been able to lift its equilibrator and scud before the wind, it would have been carried more than half-way across the Atlantic inside of two days by the first storm; for the meteorological charts show that this storm traveled to within a few hundred miles of the other side before it was spent. As a rule, it takes from three to four days for a storm to cross from the western to the eastern shores of the Atlantic Ocean. As is well known, the winds of a storm always blow toward the storm center. As a storm center moves up our coast, the winds blow toward it from the northeast, but when it passes beyond us out to sea, it is followed by westerly winds. It is Mr. Vaniman's plan to start after a storm center has passed from 800 to 1,500 miles out to sea. Then on the wings of a western wind, he will be carried toward this center, which, in the meantime, will be moving rapidly across the ocean. By driving his airship at the rate of 20 miles an hour, he will succeed in moving faster than the storm center, and he confidently expects to be able to cross the Atlantic, under such conditions, in less than four days.

Navigating Instruments.

In connection with the airship expedition, Mr. Vaniman has devised a number of interesting instruments which will indicate the direction of his travel, and also his speed. One of these consists of a combined camera and compass, the camera having its field divided into squares. Noting how long a fixed object on the water below takes to pass across a given number of squares and knowing his height above the water, as indicated in the barometer, he will be able to determine definitely his speed over the water, and, by referring to the compass, his direction of travel. The only fixed objects on the ocean are the white caps. It will be recalled that, although waves travel, the water that forms them is practically stationary. Hence the foam of a white cap may be considered a fixed object on which observations may be made. In addition to this, Mr. Vaniman has invented a sextant of an interesting type, for use on the expendition.

Despite the sensational nature of the expedition, Mr. Vaniman cannot be considered a mere adventurer. He is intensely interested in mechanics and invention, and in no other field does he consider that there are such possibilities as in the future dreadnought of the air, the dirigible balloon.

Electricity

Experiment in Purchasing Electricity.—The work of electrifying the lines from Lauban to Konigszelt is soon to be begun. The current for these lines will be bought from commercial electric power stations, instead of being supplied by a power station built by the railroad itself. The decision to purchase power was made in order to determine whether this would be a cheaper way of operating the line than if the power were generated by a station built especially for the railroad.

Telephone Precautions in Gas Works.—An investigation was recently made in Germany to determine whether any accidents had ever occurred in gas works by the ignition of gas with sparks from the telephone apparatus. No such accidents were reported, although it was found that gas could be ignited if it were projected upon the instruments while they were in operation. Hence the Association of German Gas and Water Works has decided to permit the use of telephones in gas works, but requires that they be protected. The bells, for instance, should be covered with a wire gauze guard.

Restoring Sulphated Cells.—A method of restoring sulphated storage cells was recently described in the *Journal of Physical Chemistry*. It is recommended that the cell be restored by charging it at the usual rate in a solution of sodium sulphate. The sodium sulphate should be pure, and the best concentration is found to be 200 grammes $Na_2SO_4 10H_2O$ per liter. A 60 hours' charge should be sufficient to restore the cell. The cost would be exceedingly small as compared with the method now sometimes used, of charging the cell at half the normal rate for a long time in the ordinary battery acid.

Cactus Telephone Poles.—According to a recent press report, the government is about to build a telephone from Tucson, Arizona, into the Catalinas, for the forestry service. The building of the line will be rather difficult, owing to the rocky nature of the country, which will make it impossible in some places to set wooden poles of the ordinary type. It has been proposed that in the canyons the cacti growing along the line be used. Brackets will be fastened to the cacti, and the wires will be supported on the brackets in the usual way. This type of pole may be adopted wherever cactus grows along the line, provided it does not require too much zigzagging.

The Boston Electrical Show of 1912.—Plans are under way to make the electric show in Boston, from September 28th to October 26th, 1912, the largest electrical exposition ever held in the world. The entire Mechanics Building in Boston will be used. This building has 105,000 square feet of exhibit space, not counting the halls and aisles, and a seating capacity for over one hundred thousand visitors at one time. It is hoped that this electric show will afford an impressive demonstration of the possibilities of electric development, particularly in New England. There seems to be a wide-spread electric awakening in New England, which is extending beyond the cities to the rural districts as well.

Electric Cranking for Automobiles.—One of the prominent automobiles for 1912 will be equipped with a generator and storage battery normally used for lighting the lamps and igniting the engine, but with the generator so arranged that it may also be used as a motor to "turn over" the engine, thus obviating the necessity of cranking by hand. When the operator pushes the clutch pedal, a gear wheel on the electric motor will engage with teeth on the fly wheel, and the motor will be operated by current from the storage battery, to turn the fly wheel and start the engine. When the engine starts the motor becomes a dynamo, and generates current to be used for charging the storage battery, and for ignition purposes.

Science

The University of the Philippines.—According to the *Manila Free Press* it is expected that Vice-Governor Gilbert will select several new members of the faculty of the University of the Philippines during his visit to the United States. Physics apparatus to the amount of $2,500 has recently been purchased. Several hundred students are now in attendance.

Standard Time in Portugal and Her Colonies.—Following the good example recently set by France, Portugal and all the Portuguese colonies will adopt standard time, in accordance with the recommendations of the Washington Meridian Conference of 1884. The change takes effect January 1st, 1912. Western European time (i. e., Greenwich time) will be used in Portugal, the islands of Principe and Sao Thomé, and Whydah.

A Double Shooting Star.—The rare (if not unprecedented) observation of a double shooting star was made by the Abbé Verschaffel, director of the observatory at Abbadia, at Hendaye, France, at 3:17 A. M., July 22nd, according to a note published in *L'Astronomie*. The larger of the two components was eight or ten times as bright as Venus, and left a slight trail; it was followed at a distance of about four degrees by its companion, which was as bright as Venus. Both objects were white. They moved rather slowly from west to east.

Prof. Schuster to Lecture at Johns Hopkins.—A course of lectures will be given between October 16th and 28th in the physical laboratory of Johns Hopkins University, Baltimore, by Arthur Schuster, F.R.S., honorary professor of physics in the University of Manchester. Prof. Schuster will discuss the cosmical applications of recent advances in physics, explaining the methods of examining correlations between solar and terrestrial phenomena, and pointing out the problems in solar and terrestrial physics that seem to call for special investigation. Meteorologists and climatologists will be interested to know that the lecturer proposes to disprove the existence of Ed. Brückner's 35-year meteorological cycle.

A Martyr to the X-Ray.—Dr. Hall-Edwards, of the Birmingham University, according to the *English Mechanic and World of Science*, has not been spared the payment of a heavy price for the benefits he has conferred on mankind by his researches in X-ray photography. A short time ago both his arms were amputated as a consequence of the dangerous experiments he had carried out. He has just made the novel suggestion that photography should be included in the ordinary university course of training. The connection between photography and art, he thinks, has been overrated. Nothing has helped science more than photography of late years, and it should, therefore, receive more attention than it does at present in the education given both in schools and in the universities.

The Telephone and the Phonograph.—A reproach which has often been raised against the telephone is that it leaves no trace whatever of the conversation transmitted. Thus, a telephone conversation can never figure in a law suit. It is not surprising, therefore, that for some time past efforts have been made to devise an apparatus by means of which a permanent record can be kept of the words spoken over the telephone, and the phonograph has often been thought of in this connection. According to a note reproduced in *La Nature* from *L'Elettricista*, Prof. P. Perotti has just scored a success in this direction. The telephone receiver is composed of two loud-speaking telephones; one of these is furnished with the usual mouth-piece; the other is connected with the vibrating membrane of a Pathé phonograph. The current required for this telephone is a little greater than for ordinary installations. The phonograph record can be made to reproduce the speech in the usual manner.

Engineering

A Tunnel Under the Yangtze.—It is stated, on the authority of the *London and China Telegraph*, that a report has been made to the viceroy of Kiangsu on the much-talked-of project of a bridge over the Yangtze River. The report is said to be adverse to this project, and to advocate a tunnel, as more practicable and much less expensive.

A Year's Progress at Panama.—The total amount of excavation in the Atlantic, Central, and Pacific divisions during the fiscal year 1910-11 was 31,804,120 cubic yards. There were excavated in the Atlantic Division 6,738,513 cubic yards. The total excavation in the Central Division was 18,522,692 cubic yards, of which 16,221,672 cubic yards were removed from the Culebra section, locally known as Culebra Cut, and the remainder—2,301,020 cubic yards—from the Chagres River section. Excavation in the Pacific Division aggregated 6,542,915 cubic yards.

Photographic Views of the "Liberté."—The photographs of the wreck of the "Liberté" show how similar were the effects of the explosion of her magazines to those observed on the "Maine." This is not surprising. In both cases the energy of a large amount of explosives was suddenly developed at a point many feet below the surface of the water. The resulting gases, unable to escape through the bottom or sides of the ship, being resisted by the incompressible water, expended their energy in tearing apart the decks above and folding them back, forward upon the bow, and to the rear upon the superstructure.

The Latest Atlantic Liner.—Not a great many years ago the new Anchor liner "Cameronia," the latest addition to the fleet of large passenger ships on the Atlantic, would have been hailed as the largest ship afloat; but so rapid is the increase in length and size that a handsome ship of this class will slip into a port like New York on her maiden voyage with scarcely more than a passing notice. She is 530 feet in length, and at full load displaces 17,000 tons. Built at the yards of D. & W. Henderson & Co., Ltd., she is not only the largest vessel launched from that yard, but is the most up-to-date vessel possessed by the Anchor Line.

Widening the Corinth Canal.—The canal which cuts the Isthmus of Corinth was opened in 1893, its route being the same as that over which the Romans tried unsuccessfully to construct a canal in the time of Nero. Although it shortens the journey from the Adriatic to the Piræus by 202 miles, this canal has been little used by foreign steamships, on account of its narrowness and the strong current, which makes the passage dangerous, and it has hardly been successful as a financial enterprise. Operations have now been begun, however, to widen the canal, so as to make it navigable for vessels of the largest size. The cost of the improvements is estimated at $160,000.

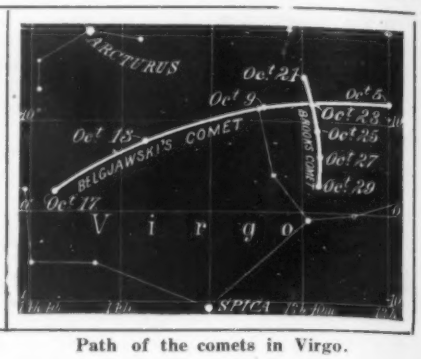
Advantages of Internal Gear Drive—The advantages of gears over chains as a motor-truck drive may be enumerated as follows: The gears can be properly inclosed and lubricated and any range of reduction obtained. The differential can be run at a higher speed and hence at less strain and higher efficiency than chains. The bevel gear reduction can be made one to two, while with the chain the bevel reduction is found to be in general one to three, and one to four. The former, therefore, is a more efficient bevel gear because the efficiency of the bevel gear decreases when the ratio of reduction increases. The side swaying of cars causes chains to get out of line and thus increases wear. The stretch of the chain must be taken care of from time to time by readjustment of the radius rods. Both radius rods must be given uniform readjustment or the rear wheels will not run in line. Few laymen can do this. Bevel gears are at all times in positive relation to one another and do not require readjustment.

Diagram of Brooks's comet.

Three Comets Now Visible

Directions How to Find Them

By Prof. S. A. Mitchell, Columbia University



Path of the comets in Virgo.

TWO comets are now visible to the naked eye, one in the evening and one in the morning sky, and a third one may be seen with an opera glass or small telescope if one cares to look for it.

The year 1911 has been rather remarkable in that no less than seven comets were discovered in the nine months before the end of September. The sixth comet for the year, known in astronomical circles as comet *f* 1911, was discovered abroad on the evening of September 23rd, by Quenisset, while the seventh comet, or comet *g* 1911, was picked up on the morning of September 29th by Belgjawsky, making it the first comet ever discovered in Russia.

For a few days after the discovery, it appeared as if Belgjawsky's comet were going to fulfill the wish for a brilliant comet expressed by the writer in SCIENTIFIC AMERICAN, September 30th, page 299. On September 30th, the morning after its discovery, on a rather bright sky due to the coming of dawn, Prof. Frost at the Yerkes Observatory saw the comet's nucleus as bright as Regulus, the chief star in the "Sickle," with a tail 5 or 6 degrees in length. Under slightly more favorable circumstances, the comet would probably have been as bright as Halley's, when this interesting visitor was present in the morning skies.

Unfortunately, however, the comet did not live up to expectations, so that now we have not a comet in the sky so brilliant that all may see it without the aid of special directions.

When a comet is discovered, it is necessary to calculate its orbit, and predict where it will be in future by the aid of an "ephemeris." As mentioned in the article on Brooks's comet (SCIENTIFIC AMERICAN, September 30th) most of the orbits are computed on the assumption that the comet is moving in a parabola about the sun. The position of the comet in space at any time depends on five quantities which are called the *elements* of the orbit. The plane of the comet's orbit in space is defined by its relation with respect to the ecliptic, and it takes two quantities to express this. One of these quantities is the line in which the comet's plane and that of the earth, or ecliptic, intersect. This is called the *line of nodes*. The other is the angle between the two planes, or *inclination*. When the comet crosses the ecliptic, passing from the south to the north side, it is said to be at the ascending *node* (symbol, ☊). To determine the direction of this line in space, we need the longitude of the ascending node, which is the angle in the plane of the ecliptic from the vernal equinox to the ascending node.

The third element needed is the direction of perihelion in the plane of the orbit. This is called the *longitude of perihelion*, and is the angle in the plane of the orbit from the ascending node to the perihelion point. The fourth element is the distance of the comet from the sun when at perihelion, and the fifth, the time at which the comet is close to the sun.

Each observation of a comet's position gives two co-ordinates, right ascension and declination; and hence to determine the five elements, three complete observations are necessary. Obviously, it would be exceedingly difficult to tell the exact curve in which the comet is moving from a very small section of its orbit, and when it is remembered that the center of a comet has nothing well-defined about it and is difficult to measure, it is not surprising that two preliminary orbits calculated by different persons from different observations perhaps, will disagree quite a little.

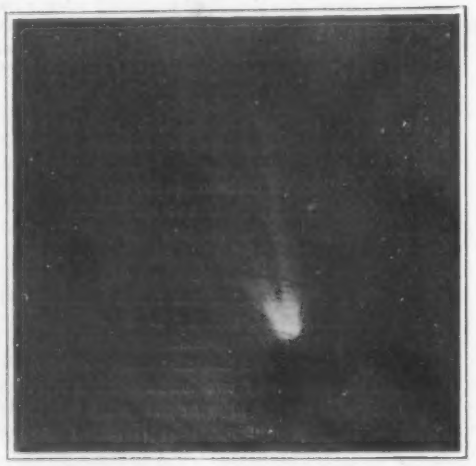
After the elements are known, it is possible to calculate the right ascension and declination which the comet will have at dates in the future. A comparison of the calculated places and those observed will give a means of estimating the accuracy of the cometary orbit.

Ordinarily the three observations used by the calculator for the comet's elements are those first published, which generally come on successive nights.

A cablegram from Prof. Kobold of Kiel, Germany, to Prof. Pickering of Harvard College, and by the latter distributed to American astronomers, gave the information that Kobold had computed an ephemeris for Belgjawsky's comet from observations made September 30th, October 1st and 3rd. The elements were:

Time of perihelion passage T = 1911 Oct. 10. d. 26 G. M. T.
Perihelion minus node ..... ω = 71 deg. 39 min.
Longitude of node ..... Ω = 88 deg. 44 min.
Inclination ..... i = 96 deg. 38 min.
Perihelion distance ..... q = 0.0304

Brooks's comet September 22nd, 1911. Photographed with 10-inch Bruce telescope.



Belgjawsky's comet September 30th, 1911. Photographed with 10-inch Bruce telescope.

The ephemeris for Greenwich midnight follows:

		RIGHT ASCENSION.	DECLINATION.
1911	Oct. 5	12 hrs. 1 min. 39 sec.	+12 deg. 11 min.
	9	12 hrs. 57 min. 53 sec.	11 deg. 33 min.
	13	13 hrs. 50 min. 4 sec.	7 deg. 45 min.
	17	14 hrs. 30 min. 30 sec.	2 deg. 16 min.

A glance at the above elements at once showed to the expert astronomer that this was a most unusual comet. Here was a comet moving almost at right angles to the plane of the ecliptic, and remarkable for that reason. The unit for measuring distances to comets is the distance from the earth to sun, and here was a comet coming within 3,000,000 miles of the sun. This insured that the comet would be a brilliant one, but the perihelion passage occurring on October 10th told that the comet would soon dwindle in brilliancy. The right ascensions and declinations of the comet showed that it was moving south and east, and since the comet was visible before sunrise, this meant that it would become invisible in the glare of the sun, to be seen later in the west after sunset. On October 17th, Belgjawsky's comet set at 7 o'clock, and may be now seen shortly after sunset at the position given on the diagram above. The comet is now but a shadow of its former self.

The photograph shown is one by Prof. Barnard on September 30th at 4:34 A. M. with an exposure of only five minutes. The tail was 5 or 6 degrees long to the naked eye, but the exposure had to be cut short on account of the approaching dawn. On October 4th, another photograph by Prof. Barnard shows a tail of about 8 degrees, slightly curved. The convex side was toward the north with a streamer extending southward at an angle of 60 degrees with the main tail. Considerable structure showed in the main tail and it had a shredded appearance. On the next morning the sky was very hazy and Prof. Barnard could see only the nucleus. The original of the photograph of September 30th here reproduced shows much detail about the comet's head with a system of many streamers which go out from the head and give the tail a fan shape. On this same morning, comets Brooks and Belgjawsky could be seen at the same time with the naked eye—the former in the northeast near the handle of the Dipper, and the latter in the east near the horizon.

Brooks's Comet.

Brooks's has been a most interesting comet because it has remained visible for so long to the naked eye. On October 21st, this comet rises at four o'clock about 20 degrees north of east, and rises about the same time for the week following, but each morning more nearly east. Brooks's comet may be found from the diagram in the constellation of the Virgin. It will be seen from this diagram that the paths of Belgjawsky's and Brooks's comets cross each other, but at the present time, the former is visible in the evening sky, east of the sun, the latter in the morning sky, west of the sun. The exquisite photograph of Brooks's comet by Prof. Barnard, reproduced here, was made at 9:10 P. M., September 22nd, with an exposure of three hours and a half, and shows a tail for about 9 degrees. The trails of light on the photograph are the stars which become elongated to lines of light as the comet moved with respect to the stars while the photograph was being taken. The comet was followed closely for the 3 hours 30 minutes necessary to make the exposure by keeping the eye constantly at the eye end of the telescope attached to the camera for guiding purposes.

The diagram of Brooks's comet shows that it was picked up about as soon as it possibly could be. The diagram also shows that in November the comet will be moving directly away from the earth and will dwindle in brightness very quickly.

Quenisset Comet.

This comet is fainter than the other two, and has suffered in consequence. It was discovered 15 degrees from the North Pole. On October 19th it was in the middle of the Northern Crown. It passes almost due south about a degree a day from the Northern Crown into the Serpent. It is very slowly increasing in brightness.

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Freaks in Art and Their Scientific Explanation

THE grotesque has always had its place in art. Probably the commonest example of the artist's indulgence in peculiar vagaries of his creative fancy, are the gargoyles which adorn certain portions of Gothic structures. Some logical justification for the introduction of these grotesque figures is derived from the symbolical significance attached to them. Now and again in a work of art is found a similar element of freak, though it is not always easy, in such cases, to divine the author's reasons for resorting to such peculiar eccentricity. Two famous instances of this kind are figured in our illustrations, reproduced from the *Illustrated London News*. The first of these is a copy of Holbein's "Ambassadors," in the foreground of which, apparently without relevance of any kind, appears a skull, distorted almost out of recognition, its outline being roughly fish-shaped. There has been a good deal of discussion as to the significance of this picture. The explanation which bears the greatest semblance of probability is one given by Miss Mary F. S. Hervey, according to which the two personages appearing on the painting are identified as Jean de Dinteville, Ambassador from France to England in 1533, and his friend, Georges de Selve. A recent discovery has placed beyond question the correctness of Miss Hervey's conjecture. A companion picture to the one here reproduced has been discovered, on which the same Jean de Dinteville appears, his name being worked into the hem of his garment. The evidence is such as to fully establish the identity of the Ambassador. As regards the mysterious skull in the foreground, Miss Hervey tells us that Dinteville had become acquainted in England with Holbein's "Dance of Death" series, and had adopted the skull as his personal badge.

Our second illustration shows a view of an extraordinary portrait of Edward VI. This portrait is so distorted that it presents a normal appearance only when viewed through an aperture in a screen attached to the side of the frame. The painting is described in the catalogue of the National Portrait Gallery as "Edward VI; King 1537-1553; Painting in Perspective, 1546, by a French Artist." It is difficult to imagine what motive the painter might have had in choosing this strange method of presentation, unless it was purely a desire to do something unusual.

Holbein's "Ambassadors" with the mysterious skull in the foreground.

The "Painting in Perspective" of Edward VI.

Man's Fossil Remains

DR. W. D. MATTHEW, Curator of the American Museum of Natural History, has given the following information to the editor of the New York *Times* in answer to a curious correspondent, who asked: "How do scientists account for the fact that so very few fossil human bones are found, while those of animals, that seem to have lived in the same period, are plentiful?"

"Human remains," says Dr. Matthew, "are found only in the latest geological formations. No authenticated remains are older than the Pleistocene epoch (ice age). In North America they are all very late Pleistocene. They are not especially rare as compared with the remains of lower animals, but most of the finds are due to interments of one kind or another.

"In the older formations (Tertiary and preceding periods) the bones of extinct animals are found, sometimes in abundance, but no remains certainly attributable to man or to any direct ancestor of man have been found. All reports to the contrary are based on questionable or insufficient evidence. These facts are true of the regions which have been extensively explored for fossil remains, viz., the greater part of Europe, a large part of the United States, and minor areas in other parts of the world.

"The obvious inferences are that man probably did not inhabit these parts of the world until during or after the great ice age; that he did not evolve from lower animals in these regions, and that the practice of interring the dead, instead of leaving them at the mercy of wild beasts, was a very ancient and universal custom among primitive races of man.

"The regions explored are a small fraction—possibly five per cent—of the area of Tertiary formations of the same nature known or believed to exist in different parts of the world. There are vast areas of promising "badlands" in every continent, which have been little or not at all searched by fossil hunters (these specimens are very rarely noticed or recognized by others). Even in the Western States, fifty years of exploration are so far from exhausting the field that every summer some expedition reports finding extinct animals hitherto unknown to science. Nevertheless, we know enough to make it very improbable that the ancestry of man will be found in the Tertiary of North America. There is a great deal of indirect evidence, in the present distribution of the races of mankind, and what is known of the history of their migration, and from other sources, all pointing toward Asia, and especially Central Asia, as the original home of the race and the theater of its evolution during the Tertiary period. This is unexplored territory to the paleontologist, and too difficult and dangerous for systematic search even to-day. But if it is opened up to exploration during the next half century as the Western States have been in the past fifty years, we may look to find there the remains of Tertiary ancestors of man along with those of various lower races of animals which are believed to have originated in that region. If, after a thorough search, this belief is not substantiated, explanations will be in order, and it will be necessary for us to modify or reconsider our present views as to where and how man originated."

The Influence of Environment on the Composition of Wheat

THE variation in the composition of plants of the same species when grown under different conditions has been the subject of so much study during the past half century that a monograph published by the United States Department of Agriculture on the subject will undoubtedly be welcomed by students of physiological chemistry. The monograph in question was prepared by Mr. J. A. Le Clerc, with the collaboration of Sherman Leavitt, and is entitled "Tri-Local Experiments on the Composition of Wheat."

The experiments recorded were begun in 1905 with the collaboration of the Office of Grain Investigations of the Bureau of Plant Industry, and consisted in growing wheat from the same original seed continuously in each of the three apices of a triangle, for example, (1) in Kansas, Texas, and California, (2) in South Dakota, Kansas, and California. The crop from each apex was then sent to the other two stations and there grown under the same conditions as the continuously grown seed. There were thus three plots at each apex, or station, all from the same original seed; one plot grown continuously at that point, the seed of the other two plots coming from the other points of the triangle. By this interchange of seed it was possible to determine the influence of climate and soil and of the kind of seed on the composition of the crop.

From the data obtained the following conclusions may be drawn:

Wheat of the same variety obtained from different sources and possessing widely different chemical and physical characteristics, when grown side by side in one locality, yields crops which are almost the same in appearance and in composition. Wheat of any one variety, from any one source, and absolutely alike in chemical and physical characteristics, when grown in different localities, possessing different climatic conditions, yields crops of very widely different appearance and very different in chemical composition. These differences are due for the most part to climatic conditions prevailing at the time of growth. The results so far obtained would seem to indicate that the soil and seed play a relatively small part in influencing the composition of crops. The practice of trying to improve crops in one locality, which crops are to be grown in another locality of widely different climatic conditions, should be discouraged. Crops should be improved in the locality in which they are intended to be grown, or the seed should be selected from a region which has similar climatic conditions.

Rodgers's Flight Across the Continent

AVIATOR C. P. Rodgers reached Chicago at noon on Sunday, the 8th inst. He covered the 26 miles from Hammond, Ind., in 24 minutes, after a delay of two days at the latter place on account of inclement weather. His total flying time for the 1,199 miles was 21 hours and 53 minutes. During the next three days Rodgers succeeded in reaching Kansas City, 1,483 miles from New York, and about half-way across the continent.

Relative Strength of the I

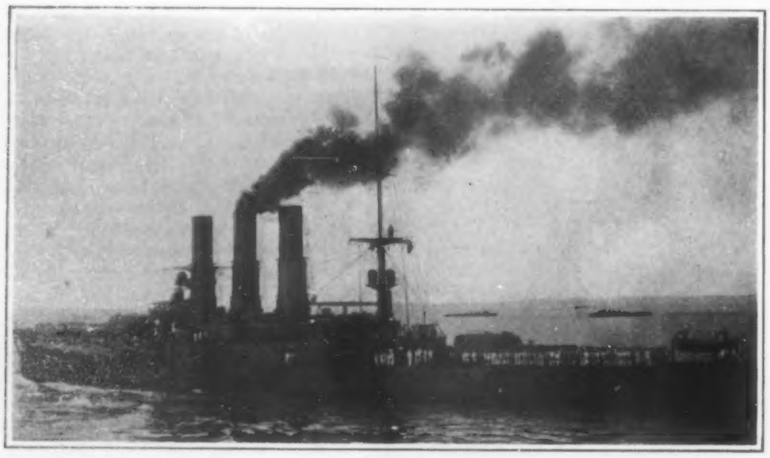
A Comparison of Fleets

Displacement, 12,625 tons. **Speed,** 22.7 knots. **Belt,** 10-inch. **Guns:** two 12-inch, twelve 8-inch.

Italian battleship "Regina Elena." "Emanuele" class. 1905-7.

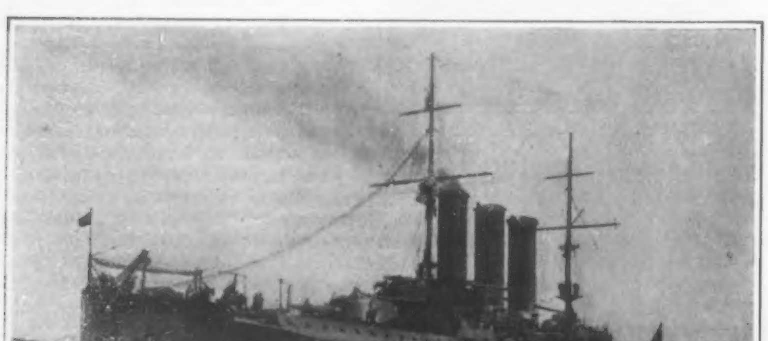
Displacement, 9800 tons. **Speed,** 18.3. **Belt,** 9¾-inch. **Guns:** four 10-inch, eight 6-inch, eight 4.7-inch.

Italian battleship "St. Bon." Also "Filiberto." 1897.



Displacement, 12,265. **Speed,** 22.5. **Belt,** 10 inch. **Guns:** two 12-inch, twelve 8-inch.

Italian battleship "Roma." "Emanuele" class. 1905-7.



Displacement, 12,625 tons. **Speed,** 22.5 knots. **Belt,** 10-inch. **Guns:** two 12-inch, twelve 8-inch.

Italian battleship "Vittorio Emanuele." Four ships. 1904-7.

EVERY naval conflict, no matter how insignificant, or how great the disparity between the rival fleets, should furnish its quota of that technical information, upon which the designs of fighting ships are based and by which changes in the strategy and tactics of the future are modified. Those of us who have followed modern naval history with any close attention will call to mind the historic fight between Chilian and Peruvian armored ships, and the value which was placed upon the technical results of that struggle.

The principal object lesson of the present war between Italy and Turkey is that of the great value of the command of the sea. War had not been declared many hours before the Turkish government found itself as absolutely separated from Tripoli, the cause of contention, as though that place were located upon the planet Mars instead of upon the opposite shores of the Mediterranean Sea.

The situation will turn the minds of all thoughtful Americans to the far-distant Philippines, Hawaii, and the Panama Canal; and the question will be asked: "Is not four, rather than two battleships a year the correct standard, if we are to hold these distant possessions beyond all possibility of loss?"

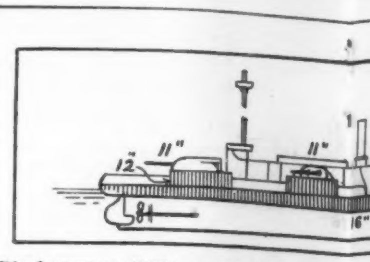
Granting that in the strength of their land forces the Italian and Turkish nations are fairly well matched, it is evident at a glance that the disparity in the naval forces is so great as to render the present contest on the high seas almost farcical. If the Turkish navy should give a good account of itself, it will certainly not be because of its strength in ships, guns and men. With few exceptions, all the ships Turkey possesses were obsolete before the keels of the modern fleets of the nations were laid.

The Turkish fleet consist of three battleships, the "Hairredin Barbarosse," the "Torgud Reis" and the "Messudiyeh." The first two are cast-offs of the German navy, which were built twenty years ago and were unloaded on Turkey last year. They were formerly the Friedrich Wilhelm and the Wiessenburg, and they carry, each, six 11-inch guns of an old pattern, in three center-line turrets. The armor is of the old compound type and the original speed of the ships was 17 knots. The third battleship, the "Messudiyeh," built in 1874, reconstructed in 1902, is of 10,000 tons displacement, 16 knots speed, and is armored with two 9.2-inch guns and twelve 6-inch, and protected with 12-inch iron armor. These three battleships combined would be no match for any one of the modern Italian battleships

In the protected cruiser class, Turkey possesses three modern vessels, the "Hamidieh" and a sister ship, both of which were built in Europe. They are of 3,800 tons, and 22 knots speed, and carry two 6-inch and eight 4.7-inch guns. Another modern vessel is the "Medjidieh," of 3,330 tons, built by the Cramps, in 1904. This is also a 22-knot vessel, carying two 6-inch and eight 4.7-inch guns. All three of these cruisers rely for protection on a 4-inch protective deck.

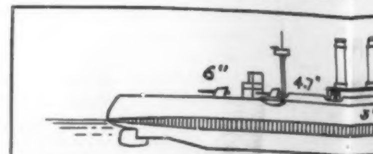
The rest of the fleet is made up of four obsolete vessels, of 2,400 to 5,000 tons displacement and 12 knots design speed, built in the 60's, carrying iron armor and four 6-inch guns, which are to-day of practically no value. Two 775-ton gunboats, built in 1906, a 500 ton gunboat built in 1907, one of 775 tons built in 1890 and seven of 213 tons and 12-knot speed, built in 1907-09, with eight other gunboats of 200 to 600 tons, and 12-knot speed, complete the list of larger vessels of the Turkish navy.

In destroyers Turkey possesses some modern vessels, including four of 620 tons and over 30 knots, and four of 305 tons and 28 knots. The navy includes also fourteen tor-



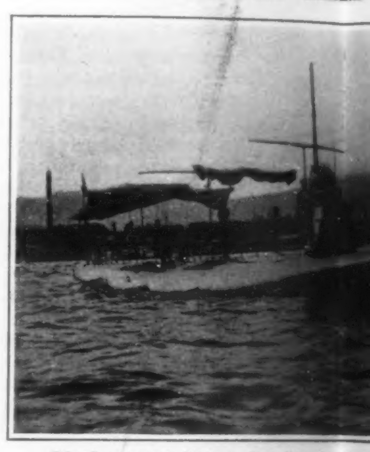
Displacement, 10,000 tons. **Speed,** 17 knots. **Belt,** 16-

Turkish battleship "Torgud Reis.



Displacement, 3800 tons. **Speed,** 22 knots. **Deck,** 4-in

Turkish cruiser "Hamidieh."



Displacement, 160 tons. **Speed:** surface 14 knots

Italian submarine "Narvalo."

Displacement, 7400. **Speed,** 20 knots. **Belt,** 6-inch.

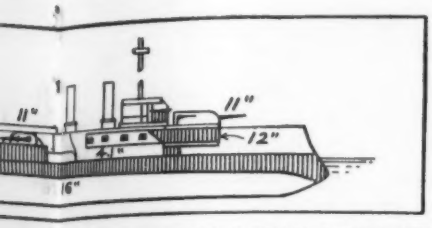
Italian armored cruiser "Varese."

Displacement, 10,118 tons. **Speed,** 22.5 knots. **Belt,** 8

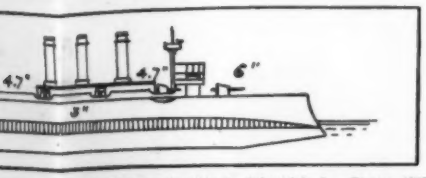
Italian battleship "Amalfi," also

he Italian and Turkish Navies

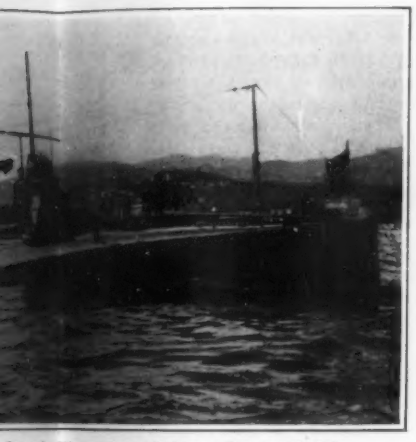
f Fleets Ancient and Modern



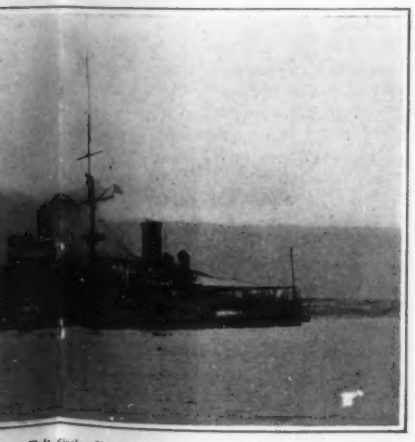
nots. **Belt,** 16-inch. **Guns:** six 11-inch; eight 4-inch. **Date,** 1891.
Torgud Reis." Also "H. Barbarosse."



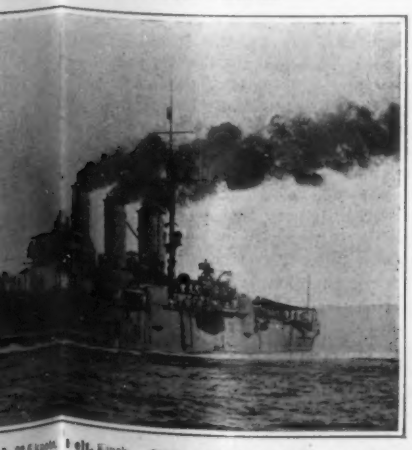
nots. **Deck,** 4-inch. **Guns:** two 6-inch, eight 4.7-inch. **Date,** 1903
"Hamidieh." Class of three ships.



ed: surface, 14 knots, submerged 9 knots. Two torpedo tubes.
ne "Narwlo." Five vessels. 1903-6.



nots. **Belt,** 6-inch. **Guns:** one 10-inch, two 8-inch, fourteen 6-inch.
ruiser "Varese." Three ships. 1899-02.



d, 23.6 knots. **Belt,** 8-inch. **Guns:** four 10-inch, eight 7.5-inch.
hip "Amalfi," also "Pisa." 1907-8.

pedo boats, built between 1901 and 1907, of 26 to 27 knots speed.

From the above enumeration it will be seen that the Turkish navy is incapable of fighting a fleet action with a modern navy. Her fast cruisers, in the hands of skilfull and daring officers, might prove effective in damaging Italian commerce or threatening the line of Italian communications; although Italy's fast cruisers should be able to capture and destroy these vessels or drive them under the shelter of Turkish land fortifications.

The Italian navy is worthy of a maritime people who have contributed largely to the development of the modern types of warships. The battleships in particular are noted for carrying unusually heavy armaments and possessing speeds that are higher than the average of other navies. The most important vessels are three of the "Conti di Cavour" class, 21,500 tons and 22.5 knots, which are the first battleships to carry thirteen 12-inch guns, nine of them in three 3-gun turrets and four in two 2-gun turrets, all on the center line. Practically completed is another fine ship, the "Dante Alighieri," 19,000 tons, 23 knots, which will carry twelve 12-inch in four 3-gun center line turrets.

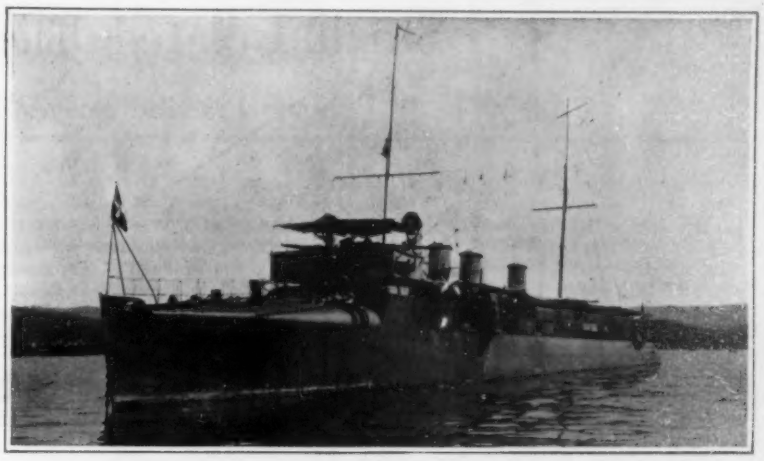
Of pre-dreadnoughts the Italian navy possesses four of the "Vittorio Emanuele" class (1904-7), viz., the "Emanuele," "Regina Elena," "Napoli" and "Roma") 12,625 tons, 21 knots, carrying in turrets two 12-inch and twelve 8-inch, and protected by a 10-inch belt of Terni face-hardened armor. The "Benedetto Brin" and "Regina Margherita" (1901), of 13,427 tons and 202 knots, are heavily armed, but lightly protected battleships, mounting in turrets four 12's, four 8's and twelve 6's, and protected by a belt of only 6-inch maximum thickness. The "San Giorgio" and "San Marco" (1908), of 9,830 tons and 23 knots, carry four 10's and eight 7.5's, all in two-gun turrets. They are protected by an 8-inch belt. The "Pisa" and "Amalfi" (1907-8), of 10,118 tons, 23.6 knots, carry the same armament and belt.

In armored vessels the Italians also possess five armored cruisers, of 7,400 to 9,800 tons (1897-1902), which are of the same general class as the "Cristobal Colon," of the Spanish war, and the "Kasuga" of the Japanese navy. These are the "Garibaldi," "Varese" and "Francesco Ferruccio," of 7,400 tons and 20 knot speed, protected by a 6-inch belt, carrying one 10-inch gun and two 8-inch in turrets and a broadside of fourteen 6-inch. The other two are the "St. Bon" and "Filiberto," 9,800 tons, 18 knots speed, 9¾-inch belt, carrying four 10-inch in turrets and eight 6-inch and eight 4.7-inch guns in broadside. The "Carlo Alberto" and "Vettor Pisani" (1895-96), 6,500 tons and 19 knots, are protected by a 6-inch belt and mount twelve 6-inch and six 4.7-inch in broadside. The "Marco Polo" (1892), 4,583 tons, 19 knots, protected by a 4-inch belt and mounting six 6-inch and four 4.7 inch, dates from 1892.

The above completes the list of modern armored vessels of the Italian navy, and the fact will be recognized that the ships are generally of first-class design.

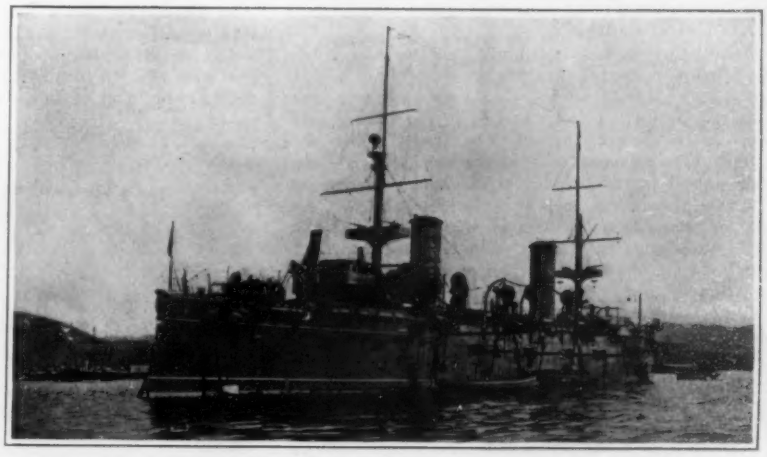
Of old armored vessels Italy possesses the "Sicilia," the "Re Umberto" and "Sardegla" (1887-91), of 13,500 tons and about 18 knots speed, armed with old 13.5 and 6-inch guns, and protected by a 4½-inch belt. Then there are the "Dandolo," "Italia" and the "Lepanto." The first-named was built in 1878, and mounts four 10-inch, seven 6-inch and five 4.7 inch guns. The "Italia" and "Lepanto," of about 15,500 tons, built in 1880-83, were phenomenal ships of their day, since they had no belt armor and yet mounted four 17-inch 100-ton guns. They were orignally built for 18 knots.

(*Continued on page 377.*)



Displacement, 380 tons. **Speed,** 28.5. **Torpedo tubes,** three. **Guns,** four 3-inch.

Italian destroyer "Bersaglieri." Ten boats. 1907-10.

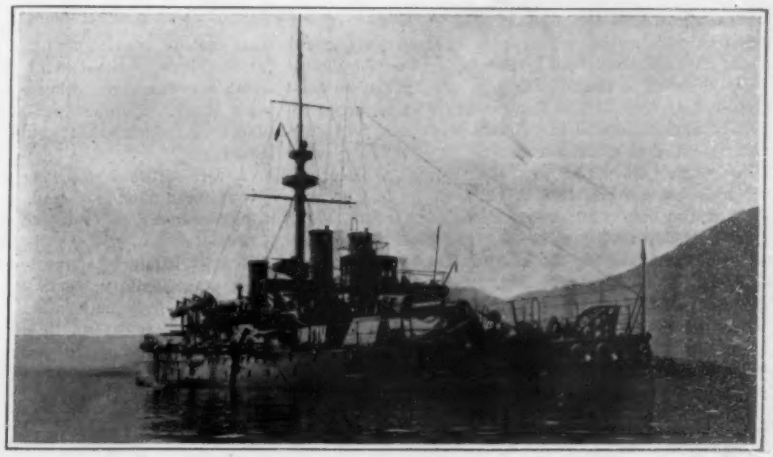


Displacement, 6500 tons. **Speed,** 19 knots. **Belt,** 6-inch. **Guns:** twelve 6-inch, six 4.7-inch.

Italian armored cruiser "Pisani." Also "Alberta." 1895.

Displacement, 13,427 tons. **Speed,** 20.2 knots. **Belt,** 6-inch. **Guns:** four 12-inch, four 8-inch, twelve 6-inch

Italian battleship "Regina Margherita." Also "Benedetto Brin." 1901.



Displacement, 13,251 tons. **Speed,** 18 knots. **Belt,** 4½-inch. **Guns:** four 13.5-inch, eight 6-inch, sixteen 4.7-inch.

Italian battleship "Re Umberto." Three ships. 1887-91.

Small Isolated Electric Power Plants

Some Practical Suggestions on Building Them

By Frederick E. Ward

EVER since the invention of the incandescent lamp, and its resulting widespread adoption for the lighting of dwellings, many persons living outside the zones supplied with current by central stations have desired to possess small lighting plants of their own. Heretofore, however, this has not been practical for the man of moderate means, because of the large amount of power consumed by the carbon-filament lamp and the necessarily large outlay for equipment and running expenses.

Recent progress in the lampmaker's art has resulted in giving us the tungsten filament, which is three times as economical in the consumption of power as the old carbon lamp, so that now an ordinary sized dwelling can be brilliantly lighted by so simple and inexpensive an outfit as would seem to place this within the reach of a great many who cannot get electricity from central stations.

The following description will give first a good idea of a suitable plant for the practical lighting of a house wired for a total of about eighteen sixteen-candle-power lamps. As all the lamps located in the various parts of a house are not required to be lighted at the same time, it is assumed that ordinarily not over seven lamps will be used, and that the maximum demand, on special occasions such as receptions or parties, will be for twelve lamps to burn all night.

In cases where a plant is to be installed principally for lighting, and it is not intended to operate electric heating devices or motors, except in small sizes and only occasionally, then thirty-two volts is probably the best selection that can be made for the system. This has been adopted as a standard voltage for the lighting of railroad cars, and tungsten lampmakers are prepared to furnish lamps for it in candle-power of 8, 12 and 16.

The necessary equipment of a plant consists of four parts; the engine, the generator, the switchboard and the storage battery. In general it is best to buy these from manufacturers who make a specialty of such apparatus, but the Handy Man who can spare the time can no doubt derive much pleasure from making a large part of the apparatus himself, as hereinafter more particularly described.

An electric lighting outfit takes up but little room, and may be installed in one corner of the tool-house, garage or other outbuilding if one does not wish to erect a separate house for it. In the photograph in Fig. 1, is shown a neat power-house of field stone, built over a live spring at the foot of a hill. The same engine that runs the dynamo also drives a lathe and grindstone, as well as running a pump supplying the house-tank with water from the spring.

The simplest and most economical form of storage battery to buy is known as the two-plate, or couple, type, which consists of two plates in each jar, supported by bent connecting straps resting across the edges of the adjacent jars. Sixteen cells are required for a thirty-two-volt system, and these, having a capacity of thirty-six ampere-hours, can be purchased for about fifty-five dollars.

Sometimes a bargain can be found in the way of a battery, suitable for a very small plant, in the second-hand or discarded electric vehicle battery of the lead type. Cells of this kind, when new, have a capacity of about 120 ampere-hours, but this is soon reduced by the severe conditions of service, and when the point is reached where the vehicle will no longer run a sufficient number of miles on a charge the battery plates have to be replaced by new ones. The old plates, which go back to the melting pot, usually can be purchased for very little money, and, when properly cleaned and assembled in suitable glass jars, will give many months of useful service.

For those who prefer to make their own batteries, however, some good hints were given in this department of the SCIENTIFIC AMERICAN of March 11th, 1911. A simpler form of construction has been devised by the author, embodying the modifications shown in the upper left-hand corner of Fig. 2, where the positive and negative elements are separated by a porous earthen flower-pot instead of by strips of wood. This construction has the advantage of a considerable saving in labor, as the lead cylinders do not have to be nicely made or riveted, and of an increase in useful life as short-circuits cannot be formed by active material falling to the bottom of the jar between the plates.

As the capacity of a cell of this kind is not directly proportional to its weight, it is more desirable to make thirty-two small cells than sixteen larger ones. The small cells can be connected in two series of sixteen each, thus becoming equivalent to sixteen cells of double the size. For those who have had little or no previous experience in this kind of work it is recommended that only one-half of the batteries be made to start with, and that the second half be attempted only after the first series have been put in service long enough to show up possible defects.

For a cell of suitable capacity, the containing vessel may be a glass jar or a glazed earthen crock having inside dimensions not less than 5½ inches diameter by 5½ inches high. The flower-pot may be 4½ inches outside diameter at the top by 4¼ inches high. Plug up the hole in the bottom by standing the pot on a sheet of paper and pouring in just enough melted sealing wax to fill the hole, but not to cover the bottom.

In assembling, put a thin layer of the granulated lead in the bottom of the crock *J*, and pack it down well. Stand the flower-pot *P* in the middle, and bend one strip of 1/16 inch sheet lead *E* to fit inside the pot and one to fit outside. These "cylinders" may be

Fig. 1.—A small power house.

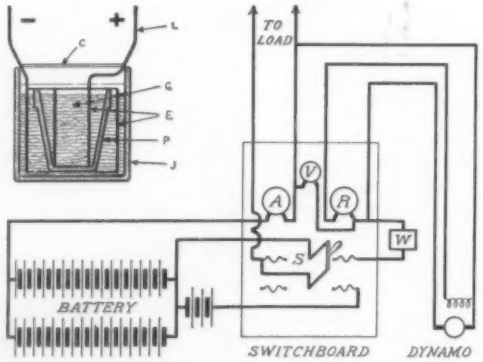


Fig. 2.—Details of storage cell and diagram of connections.

the same height as the pot, and the terminal straps *L* may be formed by bending up strips one inch wide partly cut from the metal, thus doing away with riveted connectors. Pack the remaining spaces in the crock and the pot with granulated lead *G*, up to within a quarter of an inch of the rim of the pot. It is very important to arrange the connecting straps *L* so that they may be bent to pass out at diametrically opposite points close to the rim of the crock, so as to leave room between them to lay a square of glass *C* to serve as a cover. These covers are necessary to catch the fine spray of acid that would otherwise fly out during charging.

A cell of the dimensions given requires a total of about seven pounds of lead, of which about 4¾ pounds are granulated. Granulated lead is prepared by heating melted lead red hot in the ladle and then pouring it from a height of about five feet into a pail of water. In storage battery work success depends largely on the use of pure materials. In selecting the lead for granulating reject anything suspected of containing solder, zinc or other impurities. Never use the cheap, or "commercial" sulphuric acid, or water that is "hard." Use a good quality of acid and either distilled or rain water.

The proper electrolyte to use in the cells is dilute sulphuric acid of a specific gravity of 1.2. This can be purchased already prepared, or it can be made by slowly adding one part of concentrated acid to each five parts of water. When the cells are filled to a point one-quarter of an inch above the flower-pots, the level of the liquid should be nearly an inch below the tops of the crocks.

The completed cells should be arranged in shallow wooden trays, the bottoms of which are covered with a layer of clean sand about half an inch deep. Not more than eight cells should be grouped in a single tray, on account of leakage of current over the surface of the jars and through the sand. After the jars are in place, the surface of the sand all around them may be liberally dusted with dry sodium bicarbonate (baking soda) which not only neutralizes any acid that slops over on the sand, but tends to keep the last dry, as the sodium sulphate formed is an efflorescent salt.

It is well to remember that a solution of bicarbonate of soda in water is the best wash for use in the event of any acid getting spattered in one's eyes, and the author recommends that a bottle of this be kept in a handy place for use in such an emergency.

Thirty-two of the cells made as described will cost less than twenty-five dollars for the materials alone, but to this must be added the cost of current used in the forming process, which takes considerable time.

To form the cells properly a current of three or four amperes should be passed through each series of them, either continuously or intermittently for a total of about fifty hours. Then they should be completely discharged and reversed, or given a similar charge in the opposite direction. About ten such reversals are required to develop sufficient capacity for practical purposes. When this has been accomplished always charge the cells in the direction that makes the central plate positive.

For charging the battery a shunt-wound generator, or dynamo, is required. For those who may care to build this part of the apparatus, the design given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, is to be commended on account of its very complete description. A machine built in accordance with those instructions may be made to serve a useful purpose, especially if it be provided with more modern ring-oiling bearings and carbon brushes, to insure against the need of shutting down for hot boxes and commutator troubles. A more modern and dependable generator, however, can be purchased for about twenty-five dollars. In ordering a machine it should be required to meet the following specifications: Volts, 42; amperes, 5; speed, 1,800 to 2,000 revolutions per minute; type, shunt generator.

The most satisfactory kind of power to use for driving the generator is the small gasoline engine. One-half horse-power would be ample for this purpose, but as yet few engine makers have developed anything in so small a size; so that good, reliable engines are to be had only in sizes beginning with about one horse-power, and costing from thirty dollars upward. Where there is water power available even less than one-half horse-power will give good results, since the water-wheel requires no attention and may be allowed to charge the battery slowly and for long periods of time.

Where one already has any kind of power at hand it may not be necessary to buy an engine to run the generator. For wherever there is a steam engine, gasoline engine or a water-wheel already installed for doing other work, a suitable pulley and belt may be arranged to drive the generator, and the power thus absorbed will be so small that in many cases it never will be missed.

A simple and convenient arrangement of the switchboard connections is also shown in Fig. 2. It is necessary to have an ammeter *A* to measure the current passing through the battery. The most desirable scale is one having the zero in the middle and reading up to ten amperes on each side, showing charge or discharge. A voltmeter *V* is also a great convenience, but is not essential, as the working of the generator can be indicated by a 4 candle-power 55-volt lamp.

In order to charge the storage battery, the dynamo must impress upon the battery's terminals a voltage considerably higher than thirty-two. This means that if any lamps are lighted while the charging is being done they will take so much current at the increased pressure as to be quickly burned out. To guard against this mishap there are shown in the diagram three extra cells of battery in addition to those previously mentioned. These extra cells are called c. e. m. f. (counter electro-motive force) cells, and their purpose is to oppose or neutralize about six volts of the pressure that would otherwise be applied to the lamp. The c. e. m. f. cells may be more easily made than the

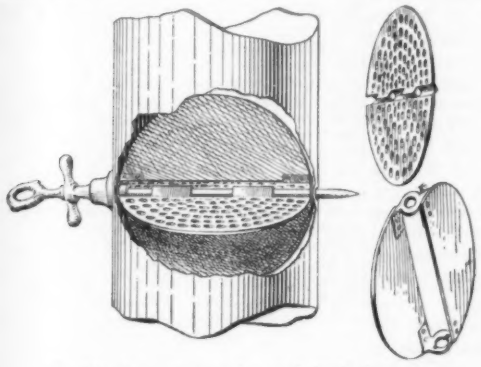
(Continued on page 378.)

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Oddities in Inventions

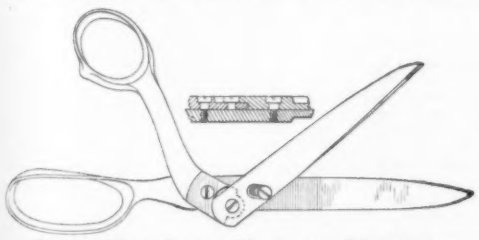
Safety Spark and Draft Damper.—Threatened with a fire in his own home by sparks passing up through the stove pipe into the chimney and alighting on the shingle roof, an inventor recently designed the damper illustrated in the accompanying photograph. It consists of two parts, one of which is the damper proper and the other the spark arrester. The spark arrester has a perforated disk which along the center line is stamped to form a square socket for a spindle. Mounted on this spindle is a handle that operates the draft damper. In use, the spark arrester normally lies crosswise in the stove pipe and the draft damper may be operated at



Combined spark arrester and draft damper.

will by turning the handle on the sleeve. A perforated plate prevents the sparks from passing up through the chimney and it also collects soot which would otherwise clog the chimney. Whenever it is desired to clear the plate of soot, the spindle may be turned, causing the spark arrester disk to strike against the draft damper and thus shake off the soot.

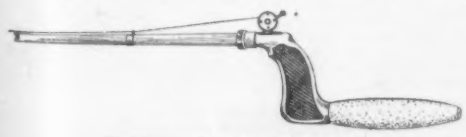
Shears With Compound Leverage.—Scissors or shears as ordinarily constructed represent the simplest type of leverage. Two inventors living in Oregon have sought to improve on this by producing a compound leverage; at the same time the blades are so arranged as to afford a draw cut, thereby improving the efficiency of the device, particularly when cutting heavy materials. As will be noted in our illustration, one of the blades is



Draw-cutting shears with compound leverage.

integral with the handle, while the other blade is fulcrumed on a screw in the first blade and is hinged to the short arm of a lever that constitutes the other handle. The fulcrum of the blade just referred to is not fixed; instead, the blade is slotted so that it is movable endwise upon its fulcrum, to compensate for the arc of travel of the short arm of the handle lever. When the handles are brought together there is a toggle action on this blade, while its movement upon its fulcrum produces the desired draw cut.

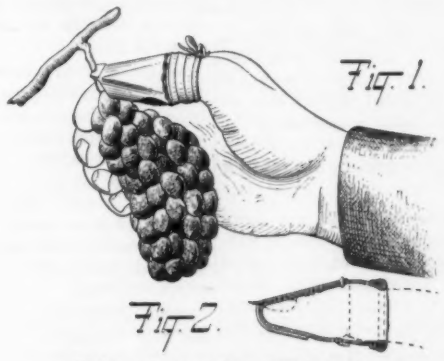
Pistol Handles for Fishing Rods.—Heretofore no particular care has been exercised in designing the handle of a fishing rod to suit the convenience of the fisherman; but a patent has just been granted to a Western inventor on a unique handle for a fishing rod, which closely resembles that of a pistol. Extending from the butt of the pistol grip is an auxiliary handle, of the type commonly used on fishing rods. Many



Fishing rod with pistol grip.

advantages are claimed for this double form of handle. The fisherman in ordinary still fishing may support the auxiliary handle under his forearm while grasping the pistol grip in his hand. This will give him a much better leverage for handling a fish, and will be less tiring.

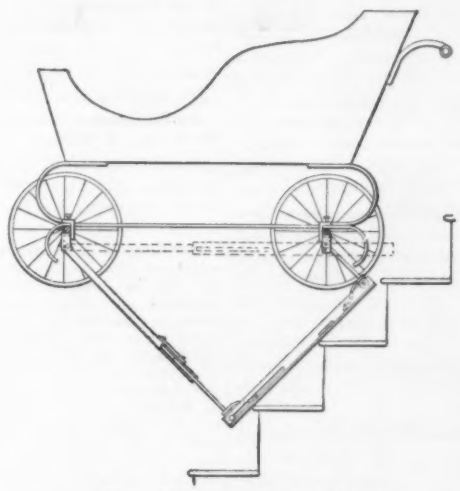
Thumb Knife for Picking Fruit.—A very convenient device for picking fruit has been designed by a man living in the fruit regions of California. It consists of a thimble, which may be tied to the thumb and which terminates in a blade with a keen edge. The fruit is seized in the hand and the stem is severed by means of



Picking fruit with a thumb knife.

the thumb knife. With such a device as this the picking of fruit is materially expedited and there is no danger of tearing the branches or marring the fruit when it is plucked.

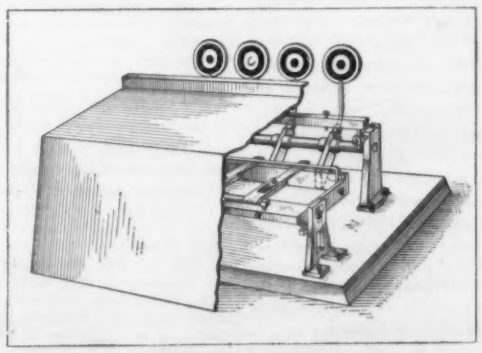
Stairway Skids for Baby Carriages.—It is always a precarious task to take a baby carriage, step by step, down a stairway. Not infrequently the handle gives way and the carriage is dashed to the bottom. Furthermore, the jar of bumping down the steps cannot be entirely avoided, and is injurious to the child. A better scheme seems to be to employ a device, such as illustrated



Up and down steps on skids.

herewith, which consists in a pair of skids that slide smoothly down the steps. The skids are permanently secured to the carriage and normally occupy the position indicated by dotted lines. When it is desired to use them, they are adjusted to the position shown in full lines. The skids are held in this position by bars attached to the front axle, which have sliding connection with the skids and hence, under normal condition, may be telescoped with them.

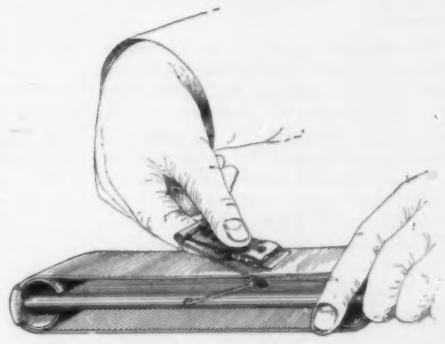
Self-setting Target.—Under certain conditions it is inconvenient, and sometimes impossible, to provide



Self-setting target.

manually operated target resetting devices, particularly for long ranges. In such circumstances, the self-setting target here illustrated should prove of value. The targets, which may be of any number desired, are mounted on bell-crank levers, weighted to keep them upright. When a target is struck by a bullet, the lever is swung on its axis, and the toe of the weighted arm snaps past a leaf spring, which serves to retain the target in depressed position. Target after target may thus be depressed, but when the last of the set has been shot down, the entire series of targets is reset. The leaf springs which hold the individual targets are mounted on a frame which is normally held in horizontal position by a counterweight. The accumulated weight of the entire series of bell-crank levers is sufficient to overbalance this counterweight, causing the frame to swing on its axis and liberate the levers, which thereupon swing back to their normal position.

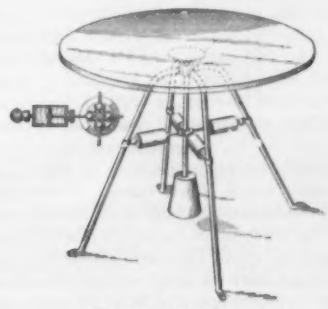
Razor-stropping Device.—The advent of the safety razor has made necessary the use of special forms of razor strops, particularly adapted for sharpening the short handleless razor blades. One of these razor stropping devices is illustrated herewith. The razor blade is gripped by a small carrier connected by a pair of



Razor-stropping device.

links to a frame around which the razor strop is stretched. Owing to the double link connection with the carrier, the razor blade is always maintained at the proper angle with respect to the strop, as it is moved along the leather. At the end of the stroke the two links serve to lift the blade clear of the strop, permitting it to be turned over to bring the opposite side to bear.

Ever-level Table for Ships.—Many different types of tables and chairs have been invented, for use on ships in time of storm. As a rule they are designed on the pendulum principle and are arranged to swing relatively to the ship, under the action of gravity, thus maintaining a constant horizontal position. The objection to this scheme is that the table or chair is apt to sway, and is never perfectly steady. Seeking to overcome this difficulty, and inventor in Texas has designed the table pictured in the accompanying drawing. The table top is mounted on a ball joint, which is supported on four



Ever-level table.

legs secured to the deck or floor of the vessel. Extending from this ball joint is a rod supporting a heavy weight at its lower end. This is the pendulum that holds the table top level. However, in order to damp the oscillation of the pendulum, four oil cylinders are attached to the table legs, while the plungers that play in these cylinders are connected by ball joints to the pendulum rod. The cylinders are filled with oil and the plungers are provided with perforations, to permit the passage of the oil through them as they move in and out of the cylinders. The viscosity of the oil tends to make the pendulum move sluggishly, but not so sluggishly as to prevent the table from keeping its horizontal position as the ship rolls.

Notes for Inventors

Attitude of Patent Office Toward Perpetual Motion.—The Patent Office regards perpetual motion as meaning a mechanical motion which creates energy, that is to say, a machine which works and operates without the aid of any power other than that generated by the machine itself and which machine, when once started, will operate for an indefinite time. The Patent Office also holds that these views are in accord with those of the scientists who have investigated the subject and are to the effect that mechanical perpetual motion is a physical impossibility. These views can be successfully rebutted only by the exhibition of a working model, and while many persons have filed applications for patents on perpetual motion, such applications have been rejected as being inoperative and as opposed to well-known physical laws and in no instance has the requirement of the Patent Office for a working model been complied with. The Patent Office will not now permit an application for patent on perpetual motion to be filed without a model, this practice having been adopted by the Patent Office to save applicants for patent the loss of fees paid with their applications in cases where perpetual motion has been claimed. After an application for patent has been considered by the Patent Office Examiner, the first government fee of $15.00 cannot be returned.

Five Patents to a Montclair Inventor.—Among the patents issued September 5th, 1911, are five patents, No. 1,002,246 to No. 1,002,249, and No. 1,002,506, to Carleton Ellis of Montclair, N. J., assignor to Ellis-Foster Company, for continuous process and apparatus for making white lead, Agricultural Spray Composition, Inoculated Humus and Process of Making Same, Electrical Oxidation of Nitrogen and Seasoning Material and Making Same.

A Telephone Mouth-piece Improvement.—Gustavus A. Duryee of New York city has patented, No. 1,002,238, a telephone attachment in which the mouth-piece is yieldingly supported in a casing, mounted upon the transmitter, so that the mouth-piece can adjust itself to the mouth of the speaker.

A New Carwheel Molding Flask.—Alfred Cordingly of Denver, Colo., has secured a patent, No. 1,003,709, for a carwheel molding flask with upper and lower sections, with upwardly projecting portions on the lower section which are beveled to engage the upper section and maintain the sections in proper relation.

A Safety Device for Flying Machines.—In patent No. 1,003,714, to Josiah W. Dalson of New York city, is shown a parachute having a lock for holding it normally collapsed and close to an aeroplane, together with means for automatically opening the parachute when the lock is released and for spreading the parachute when the lock is released, the parachute being detachably connected to the aeroplane and having secured to it a take-off connection for supporting an aviator.

High Speed Trolley Wheel.—The patent, No. 1,003,862, to Albert H. Armstrong of Schenectady, N. Y., assignor to the General Electric Company, presents a high speed trolley wheel which carries at its periphery independently pivoted blades which form freely movable contact making means that can be projected outwardly by centrifugal force to make contact with the trolley wire, irrespective of its varying distances from the axis of the wheel, and a motor is provided to positively rotate the trolley wheel.

An Automobile Door Indicator.—Patent No. 1,003,867, to Leon L. Bories of San Francisco, Cal., provides for notifying a chauffeur when an automobile door is closed. This is done by providing a door actuated mechanism which serves, when the door is closed, to operate a suitable indicator.

Paper as a Substitute for Laths.—A novel plaster support for wall covering and forming a support for plaster, comprises a flexible, laminated sheet of paper board, capable of being compactly rolled and spaced, thin, flat strengthening strips extending transversely of and secured to one surface of the paper board. This was patented, No. 1,003,754, to Frederick L. Kane of Huntington, N. Y.

A New Barber's Comb.—A hair-cutter's comb is shown in patent No. 1,003,568, to James L. Woods of Cedar Rapids, Iowa. It has teeth which gradually diminish in length from end to end of the comb, with one edge of the teeth formed with inclined portions and the remaining portion straight or parallel with the opposite edge of the teeth, so the comb can be utilized as a gage in cutting hair.

Metal Railroad Ties.—Three patents, No. 1,003,637 to No. 1,003,639, have been granted to William Henry Morgan of Alliance, Ohio, for metal railroad ties, all three of the ties being characterized by cross or transverse portions and end portions which extend lengthwise the rails for supporting the latter.

A Two-part Medicine Bottle.—A medicine bottle, having a bottle within it with the stopper of the inner bottle seated in the inner end of the stopper of the outer bottle, is shown in patent No. 1,002,293, to Richard P. McGrann of Lancaster, Pa.

An Electrically Heated Hot Water Bag.—Patent No. 1,002,253 presents a hot water bag having a removable stopper and an electrode carried by the stopper and exposed within the bag, the stopper having on its outer side special means for connection with an electric circuit, the electrode being removable with the stopper.

A Novel Lubricating Material.—Henry P. White of Kalamazoo, Mich., presents in a patent, No. 1,002,349, a packing material which includes crumpled sheet metal, coated with oil and powdered graphite and folded and compacted together.

A New Mergenthaler Line Caster.—John R. Rogers of Brooklyn, N. Y., has assigned to the Mergenthaler Company a patent, No. 1,002,320, for a line casting machine which has a magazine for use in an inclined position, which has a straight channeled body portion and a straight receiving end in alignment with the body portion and vertically partitioned.

Detection of Counterfeits.—Patent No. 1,002,600, to Edward Robert Morris and Alfred Edwin Bantree of London, England, provides for detecting counterfeits by applying to the fabric of the document distinctive identifying characters or designs and a ground work as specified, the characters and designs being discernible only by aid of a detector in the form of a special light.

Two New Edison Patents.—Thomas A Edison has in the *Gazette* of September 5th, 1911, two patents, one, No. 1,002,504, for an apparatus for crushing and separating fine materials, and the other, No. 1,002,505, for a composition for sound records and other objects. The latter is assigned to Thomas A. Edison, Incorporated, and the composition includes shellac and a halogenized Napthaline, crystallizing as fibers distributed through the shellac.

An Allis-Chalmers Turbine.—Max Rotter of Milwaukee, Wis., has assigned to Allis-Chalmers Company, of the same place, a patent, No. 1,002,813, for a turbine in which an exhaust pipe extends from an engine and is divided into two paths, one of which communicates with a condenser and the other path leads to the turbine, while a governor controls valves which limit the flow through the two paths.

Wanted: An Automatic Doffer.—If someone could invent an efficient, satisfactory doffing machine for cotton spinning machines that would be automatic in its operation, it would doubtless quickly come into general use. It should be applicable to the various styles of spinning frames and should not be limited in its usefulness to any particular style of bobbin, but should be capable of operating in connection with any of the different forms of bobbins met with in the modern spinning machine.

Legal Notes

"Collier" a Descriptive Term for Dynamite.—In the case of the Sinnamahoning Powder Manufacturing Company, the Patent Office has held that the word Collier, as applied to dynamite, is descriptive and not registrable, since it would indicate to the trade that it was intended for use in coal mining; also that the color of the package in which goods are placed cannot constitute a trade-mark for such goods, and that the Examiner of Trade-marks properly refused to allow the applicant to describe the mark as appearing on a red package.

Acquiring Trade-mark Rights.—In acquiring the exclusive right to the use of a trade-mark, the important act is the actual use of the mark on the goods to which it applies, in commerce. This, of course, includes the adoption of the mark, since it cannot be used until after its adoption, but the adoption alone of the mark, apart from a *bona fide* use thereof does not give any trade-mark rights therein. When once begun, the use of the mark must be continuous, since any cessation in the use tends to abandonment. The continuity of use depends on the goods; the market for some goods, fertilizers, seed corn and the like, has seasons of activity and seasons of quiet and the use of the mark follows the seasons.

Lecture on Trade-marks.—That the systematic study of trade-mark law is receiving more attention in the established schools of law, is evidenced by the announcement that this season Mr. William L. Symons, the Assistant Examiner in the Trade-mark Division of the Patent Office, will deliver courses of lectures on the subject of Trade-marks, Prints and Labels and Unfair Competition in Trade, in the Washington College of Law, Washington, D. C.; the Richmond College, School of Law at Richmond, Va., and the Washington and Lee University School of Law, at Lexington, Va.

An Important Decision on Reissues.—In the U. S. Circuit Court of Appeals, Seventh Circuit, in Moneyweight Scale Company, the Court affirmed the decree below, sustaining the Reissue Patent, No. 12,137. The Court said:

"Authority to grant reissues is now derived exclusively from the statute. (R. S. 4916; U. S. Comp. St. 1901, p. 3393.) And the Commissioner goes beyond his jurisdiction if he grants a reissue for an invention (though conceded to be the invention of the applicant) which is not the same invention that was disclosed and described as the applicant's invention (not merely that lurked in the drawings or description of the machine as a machine) in the original patent, which, by reason of inadvertence, accident, or mistake, is inoperative to secure the monopoly it shows on its face was intended to be secured."

Referring to the original patent, the Court says:

"The two claims allowed do not fulfill the promise. They are only for combinations of less than the total number of elements in the complete scale and are expressed in general terms. The original patent on its face was therefore inoperative to protect 'the details of construction' which the specification has particularly pointed out and which individualized the machine that appellee was manufacturing thereunder."

As to some of the claims presented during the prosecution of the original application, it is said:

"We have examined each of the twenty-seven rejected claims and have failed to find one that would be adequate to secure a monopoly of the DeVilbiss computing-scale, that would cover 'the details of construction' in which the invention as an entirety resided."

The decision refers to the fact that none of the reissue claims corresponds with the subject matter of any abandoned claim; and that no reissue claim is broader than the allowed claims, and points out that—

"Where none of the original claims presented by an applicant for a patent was adequate to cover the invention disclosed by the specification and drawings, acquiescence in the rejection of such claims is not an abandonment of the invention as an entirety, and the failure of his solicitors to submit adequate claims is an inadvertence which may entitle the applicant to a reissue."

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

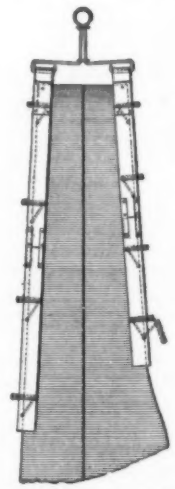
Pertaining to Apparel.

TREAD FOR BOOTS AND SHOES.—W. B. ACKER, Washington, D. C. The primary object of the inventor is to obviate many objectionable features and to present to the trade a heel or tread having a plurality of longitudinal wear resisting strips embedded therein so as to prevent slipping when walking on smooth or wet pavements, the invention being particularly adapted for use with cushion heels, as the strips do not impair the elastic or resilient properties thereof.

REINFORCEMENT FOR GARMENT FORMS.—E. T. PALMENBERG, New York, N. Y., and F. W. KREUSCH, Bayonne, N. J. The object here is to provide a reinforcement for forms arranged to prevent cutting into the cloth covering of the form by the shears of the fitter, at the same time permitting the insertion of pins or similar fastening devices, generally used for holding the garment temporarily in place on the form during the fitting process.

SKIRT.—A. GOLDBERG, New York, N. Y. The aim of the improvement is to provide a simple and durable skirt, petticoat or the like, which can be easily put on and taken off, the waist band of which is adjustable so that the skirt can be worn by persons having different waist measurements, and which provides pockets for carrying valuables and the like.

TROUSERS CREASER.—A. DOMBROWSKY, Las Cascadas, Panama. In this patent the invention is an improvement in trousers creasers and is fully shown in the side view illustration of the device as in use. The inventor's object is to provide a simple and novel construction which will be efficient in use, made in sections which can be conveniently detached to permit the device to be packed in small space and



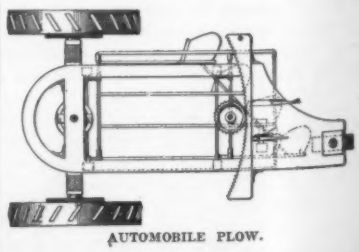
TROUSERS CREASER.

which can be quickly set up for use. By adjusting the clasp shown in the dotted line position at the bottom of the right hand side, it will operate to hold the side bars of the clamp firmly upon the trousers. If desired, the clamps may be made one longer than the other to adapt them for use at the front and rear edges of the trousers leg as shown.

NECKTIE.—I. LEWIN, New York, N. Y. This article is an improved form of reversible entirely woven necktie. One of the objects of the invention is to provide an all-woven necktie which comes from the loom completely woven, having the neckband thereof the common tubular construction and the ends forming with the neckband a reversible open-ended four-in-hand tie.

Of Interest to Farmers.

AUTOMOBILE PLOW.—OLIVER H. LINCOLN and EDSON O. PARKHURST, Brownell, Kan. This invention, the sectional side view of which is illustrated herewith, relates to automobile plows, and it has for its object to provide one, with traction wheels disposed near



AUTOMOBILE PLOW.

the front and at all times in the same position relatively to the engine, whether the plow is being driven in a straight line or is being turned to one side or the other, the plowshares being disposed under the engine and

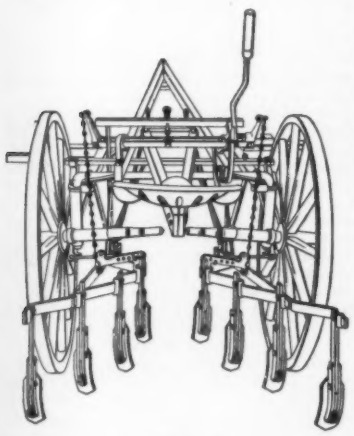
being held down to their work by the weight thereof. By a movement of a lever the plowshares may be moved up or down to a position where they will engage the earth and will do the general work desired, these plowshares being secured to the lower frame having the transverse members.

DEVICE FOR AERATING, COOLING, AND CLEANING MILK.—C. W. TICKNOR, Mount Kisco, N. Y. The intention in this case is to provide a conduit having ribs for collecting any dirt which may be in the milk, the conduit being cooled by an adjoining receptacle containing water, so that the milk will not only be cleaned, but will also be cooled and aerated when passing through the conduit.

CULTIVATOR.—W. E. BROWN, Herrick, S. D. In this machine the operator has an easy and complete control. He can follow a row closely without covering or plowing up plants that may be on one side of the row. The disks may be guided to follow a row, regardless to a certain extent of the position of the supporting frame. In this movement both hands are left free for operating other parts of the machine, thus effecting the saving of time and the operator's strength.

MOTOR DISK PLOW.—J. M. HENTON, Edgemont, S. D. This invention provides a carrying frame and traction mechanism with means arranged to propel the frame intermittently and as controlled; provides means for, at will, varying the position of the driving wheels of the traction mechanism relatively to the grinding wheels of the frame to vary the pivot on which the frame is swung; provides rotary plowing members and a rotary driving mechanism arranged to rotate the plowing members independently of the traction mechanism of the carrying frame; provides devices for gripping the ground in a manner to form traction devices auxiliary to the main traction mechanism; and provides rotary plowing devices having means for shearing surface vegetation and shattering subsoil.

CULTIVATOR.—CLIFFORD A. CORWIN, P. O. Box 466, Riverhead, L. I., New York. The cultivator shown in rear perspective view in elevation, is of the adjustable type. The purpose of the inventor is to provide one with a series of hoes connected together so as to be adjusted simultaneously with means for locking them in an elevated position out of con-



CULTIVATOR.

tact with the ground, and with means for locking them in a plurality of adjusted positions intermediate their uppermost and lowermost positions. A plurality of hoes connected together is provided with means for taking up the shock incident to the change of position of the hoes. A cultivator with a plurality of wheels, forming a carriage to support the same, the wheels being adjustable relative to the frame so as to guide the cultivator.

Of General Interest.

DISPLAY RACK.—T. N. FIGUERS, JR., Columbia, Tenn. This rack is for use in shops or stores for displaying dry goods, gents' furnishings, or other articles. The same is preferably constructed and applied as an attachment of a show-case, it being composed of foldable and detachable parts which adapt it to be extended vertically above the show-case for use, or partly dismembered and folded on the back of the show-case in such manner as to remove it from view.

TRUSS.—L. L. BAKER, Denison, Texas. This invention refers to trusses and is particularly useful in connection with devices intended for the alleviation or cure of abdominal hernia. The aim is to provide a truss in which the pads are resiliently secured to the frame of the device. Further, to provide a truss to which may be removably secured abdominal wings, and, if necessary, a suspensory.

BALANCING TANK.—L. F. RAGOT, Milford, Pa. This inventor seeks to provide a tank suitable for use upon flying machines and the like, for carrying hydrocarbon fuel used for furnishing power for the machine, the parts being so constructed and arranged that as the liquid is gradually used up and consequently the tank becomes lighter, the center of gravity of the tank remains in its original position relatively to the framework of the machine.

EYEGLASSES.—L. B. BECKER, New York, N. Y. The purpose in this case is to provide improvements in eyeglasses, whereby the pivoted nose clips can be readily placed in position on their supporting studs or removed therefrom and interchanged with a view to locate the nose clips nearer to or farther from the bridge, as required or desired by the user.

PNEUMATIC ACTION.—HERMAN MEYER, New York, N. Y. This improvement refers to self-players, self-playing pianos and like instruments, and its object is to provide a pneumatic action having a bleed hole adjustment, to permit accurate and quick regulation of the diaphragms and valves from the outside, with a view to insure proper opening and closing of the pneumatics.

AUXILIARY STOPPING DEVICE.—HERMAN MEYER, New York, N. Y. This invention relates to piano players, self-playing pianos and like instruments, and the inventor provides a device more especially designed to enable the performer to stop the motor quickly while playing and when music calls for a rest, and without the performer changing the position of the tempo lever or removing his hand therefrom.

TRADE MARK FOR A LUBRICATING OIL FOR MACHINERY.—J. A. FLEMING, Room 308, No. 328 Chestnut Street, Philadelphia, Pa. Mr. Fleming has adopted and used this trade-mark for a lubricating oil for machinery, in Class 15, oil and greases. The trade-mark is applied or affixed to bottles containing the lubricant by placing thereon a printed label on which the trade-mark is shown.

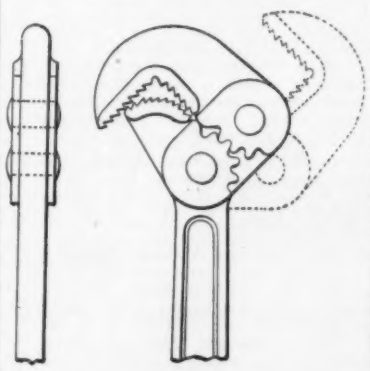
MOUSE TRAP.—H. A. QUESTROY, New York, N. Y. An object here is to provide a means to kill the rat or mouse at the time it is caught. The trap is simply constructed and has few parts which might get out of order. It is set by opening a hinged cover, drawing a closure open against the action of a spring and holding the closure by engaging a bracket with a lever, which in turn is held by a bait-holding lever.

MOLDING FLASK.—L. J. KREUTZBERG, Easton, Pa. An object of this inventor is to provide a flask made up of a number of copes, said copes being fastened together so as to form practically a unitary cope with means for fastening the cope thus made to the drag. A further object is to provide a novel form of fastening means so that the several parts of the flask may be quickly clamped together, or unclamped, as occasion demands.

STUMP BURNER.—F. P. RAND, Spokane, Wash. This is an improved device for use in burning the bodies and roots of stumps, both dry and green. It enables a stump to be destroyed quickly and easily, without the use of any dangerous explosive, while the construction is such that it may be easily manipulated and may be produced at small cost.

Hardware and Tools.

WRENCH.—F. W. FRITCHEY, Sandusky, Ohio. This wrench has a fixed jaw and a movable jaw, the latter being so connected to the handle that when it is pulled to turn a pipe, rod or other contrivance, the act of pulling not only exerts a leverage on the handle but also exerts

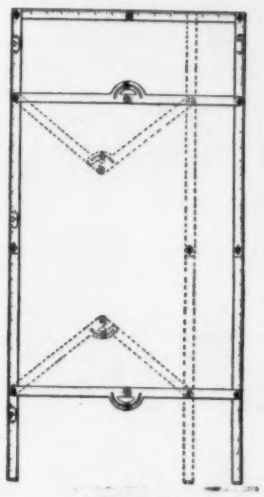


WRENCH.

a leverage action on the pivoted end of the movable jaw, causing the hold of the wrench to be tightened. The wrench is shown in side elevation in the accompanying engraving. It is simple in construction and efficient in action. It can be cheaply manufactured and is well adapted for all purposes to which tools of this description are applied.

SAW TOOL.—D. R. WILLIAMS, Whittemore, Mich. One of the objects of this inventor is to provide a simple and inexpensive saw tool, by means of which the jointing or aligning of the teeth of a saw can be effected rapidly and easily, and by means of which the cleaner or raked teeth of a saw can be filed down uniformly to any desired point.

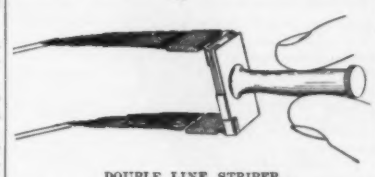
DOOR GAGE.—CARL E. ROSE, P. O. Box 194, San Diego, Cal. An object here is to provide a gage which may be extended in either direction and which is provided with means for marking the position of the hinges, etc. The gage has parts which may be used for other purposes than for gaging doors, windows, etc., as for instance a bevel square, straight-edge, plumb and level, grade finder, and slide rule. The invention provides a scale which may be folded into a small compass



DOOR GAGE.

when not in use, and one having a novel form of marking device. The engraving herewith represents a side view of one embodiment of the invention, the level and marking device being applied thereto.

DOUBLE LINE STRIPER.—HOWARD E. KING, Somerville, Conn. This invention is illustrated herewith in a perspective view. The improvement relates to a form of double-line stripers for use more particularly by carriage painters for striping the wheels and bodies of carriages, automobiles, wagons, or in any



DOUBLE LINE STRIPER.

other place where a double line is desired. An object is to provide a double striper, the distance between the brushes of which may be varied at will. The inventor attains the above outlined object by disposing two brushes on a support, and by means of a rack and pinion movement, separate the brushes as desired.

PLATE LIFTER.—JOSEPH E. WENMAN, New Philadelphia, Pa. The accompanying engraving represents the plate lifter in a perspective view. The invention relates to a form of lifter or detachable handle for articles, especially those which are too hot to be readily handled without the interposition of some such tool. The object is to provide a utensil having parts, which may readily be constructed from metal wire without the use of any connecting pivots. The relative parts are so constructed

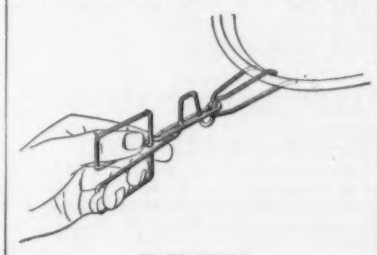


PLATE LIFTER.

that they may be mutually traced, and the parts are so constructed that they may be readily and removably locked in position. In the construction each member is made continuous of one length of wire, and there are no drilled joints.

BLADE HOLDER.—PAUL R. BUCHHOLZ, care of Chattanooga Med. Co., Chattanooga, Tenn. In this instance the invention relates more particularly to a holding device for flexible

BLADE HOLDER.

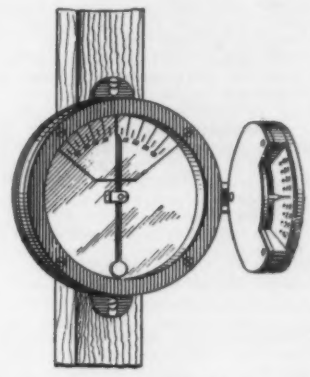
blades such as are used in safety razors. It will securely hold a blade in position for shaving or stropping. The blade is shown in the illustration herewith inserted in the holder. This is done by merely flexing it sufficiently to enter the slot and then pushing it in as far as it will go. It may be removed therefrom by pressing against the inner, upper corner, of the blade, with one finger, thereby swinging the blade outwardly above the lower corner thereof as a pivot.

Heating and Lighting.

LAMP.—F. M. EULER, Elizabeth, N. J. This invention relates to an adjustable and quick-detachable incandescent lamp. An object is to provide a lamp of any suitable type, such as an incandescent lamp, in which the lamp proper, and in this case the bulb, is adjustable to a plurality of angles, whereby the light may be directed to any desired point.

Machines and Mechanical Devices.

LISTING INDICATOR.—JOSEPH ARNST, 516 North Clark Street, Chicago, Ill. The accompanying view is of an indicator constructed and arranged in accordance with the invention, the same being shown in conjunction with a stanchion for an aeroplane. The invention provides an instrument with indicators having visible scales and indicating members mov-



LISTING INDICATOR.

able thereover to show the lateral list of such a machine as an aeroplane, and simultaneously the pitch of said aeroplane on its median transverse axis; provides an instrument, the bodies of said index member being arranged in vertical planes, the last being perpendicular; and provides for the indicator being folded into compact form.

Pertaining to Vehicles.

WAGON BOX FASTENER.—HARVEY E. BART, Broken Arrow, Okla. This invention is an improvement in wagon box fasteners, and its object is the provision of a simple, inexpensive and easily operated device for use in holding the parts of the box firmly together, without injury to the same, which may be quickly applied or removed. The accom-

WAGON BOX FASTENER.

panying illustration shows the fastener in its front view. The device consists essentially of a pair of telescoping members or bars, each having a clamping jaw at its outer end, cooperating with the jaw of the other member, and a clamp for holding the members or sections in adjusted position.

Designs.

DESIGN FOR WALL PAPER.—H. WEARNE, Rixheim, Alsace, Germany. In this ornamental design for wall paper the entire width shows a streaked effect interspersed with slightly undulating dotted lines composed of small square white dots.

DESIGN FOR AN IMAGE.—H. C. ANDERSON, Pensacola, Fla. In this ornamental design the image is a male figure of a dog in the complete costume of hat, suit and shoes of the French court type of Louis XIV.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12551) W. E. W. Y. says: On the evening of September 7th, at 7:30 o'clock, there appeared a beautiful lunar rainbow in the western heavens. At about 7 P. M. a dark cloud arose in the west, and rain fell heavily for some minutes. It was perfectly clear in the east, and the full moon, coming up from the under world, shot its rays through the rain drops, with the result of a gorgeous rainbow at night. This is the first time a phenomenon of the sort has been observed here, so far as investigation discloses. Are there many instances of lunar rainbows on record? A. Lunar rainbows are not a frequent occurrence. This one seems to have been unusually brilliant. Generally but a few colors are seen. The moon on September 7th was within one day of the full, and hence gave almost the maximum of light. This would account for the brightness of this lunar bow. The noted geologist, Edward Hitchcock, formerly president of Amherst College, Massachusetts, once said in an address, "He who has seen one total eclipse of the sun, or one transit of a planet over the sun, or one November shower of meteors, or one splendid comet, or one lunar iris, or one volcanic eruption, may be satisfied, and cannot hope for a second sight." The writer of this note has seen all of these grand phenomena of nature, excepting a meteor shower of the first rank, and a great volcanic eruption; but he has had the privilege of seeing a lunar iris on two occasions, and has seen volcanoes in action and many smaller meteor showers. The geologist was right in his list of rare natural phenomena.

(12552) F. R. K. says: I desire to copper-plate glass plates, 20 inches by 20 inches, for use as a condenser in wireless telegraphy. Will you please give some method of coating the glass to render it a conductor, and also give voltage necessary? A. Glass may be prepared for copper-plating by giving it a coat of copal varnish or of gutta percha in benzole. When this is dry, it will take plumbago in the ordinary way. Copper-plating with an acid bath requires from 0.5 to 1.5 volts. With a cyanide bath, 2 to 5 volts are needed. Various processes and formulas may be found in Watt's "Electro-Plating," price $4.50. It would seem necessary to have some good manual at hand for the numerous details of the work. It would be much easier for a novice to coat the glass with silver, as in a mirror. This process is fully described in our SUPPLEMENT 1671, price ten cents. The silver surface would be just as effective as a copper coating. The silver could be plated with copper. It might be the easiest way to obtain a base for the copper plating to deposit a thin coating of silver on the glass and plate the copper upon that.

(12553) W. A. S. asks: Have you a SUPPLEMENT that will give detailed information in regard to magnetizing magnets, such as are commonly used on such magnetos as are used for gas engine ignition? A. Unless one has a powerful direct current of electricity at his disposal, it would be better to send magnets away to be magnetized. The process, however, is simple. A coil of wire should be made of such size that it will slip over the magnets, so that the magnets may be passed through the coil. No. 16 B. & S. single cotton-covered copper magnet wire may be used, and 100 turns will be sufficient. Wind as compactly as possible and in four layers. This will make a coil about an inch and a half long and less than a half inch deep. If made for permanent use it should be well filled with shellac and dried before taking it from the form or spool upon which it has been wound. It should also be secured from unwinding by binding it with fine cord. This coil will stand ten amperes or more for some little time without overheating. For most convenient use it may be connected in series with an arc light as a resistance. It cannot be connected directly to a lighting circuit; its resistance is too low. It would be made very hot in a few seconds, or the fuses would be melted out. Pass the magnet to be charged through this coil several times. A small compass will give you the polarity of the coil and magnet.

(12554) A. D. asks: Can you give me a formula to make a solution to do electro silver plating with wet batteries? A. A solution for silver plating may be made to contain 3 ounces of silver chloride and 9 to 12 ounces of potassium cyanide per gallon of water. The mode of preparation and the care of the bath are fully given in Van Horne's "Modern Electroplating," which we will send for $1. It is quite as important to keep the bath in good condition as it is to have it right at the outset.

NEW BOOKS, ETC.

YELLOW FEVER AND ITS PREVENTION. A Manual for Medical Students and Practitioners. By Sir Rubert W. Boyce, M.B., F.R.S. New York: E. P. Dutton & Co., 1911. 8vo.; 380 pp.; illustrated. Price, $3.50 net.

The distinguished author of "Yellow Fever and Its Prevention" has had exceptional opportunities for the observation of this scourge in New Orleans, Central America, the West Indies, and Africa. His high standing in pathology and tropical medicine gives the volume an authority which no student or practitioner can afford to ignore. Many will recall his previous work, "Health Progress and Administration in the West Indies," in which was sketched the history of yellow fever in the West Indies and Central America. The present work deals more particularly with the scourge as observed in West Africa, although its general history and geographical distribution are first given. In succeeding divisions the disease is discussed from the viewpoints of symptomatology and treatment, pathology, epidemiology, and entomology, while not the least interesting and perhaps the most practical division is the closing one, under the head of prophylaxis. In this division a successful plan of campaign is drawn, which includes prompt official notification of the danger, the enforced retirement of non-immunes to a place of safety, an organized attack upon the breeding grounds of the *Stegomyia*, the evacuation and fumigation of infected bungalows, and the perforation of gutters. Plates, maps, and fever charts elucidate the text and add materially to its value.

GAS ENGINES. By W. J. Marshall and Capt. H. Riall Sankey, R.E. New York: D. Van Nostrand Company, 1911. 8vo.; 278 pp.; illustrated. Price, $2 net.

"Gas Engines" is addressed primarily, not to designers and manufacturers, but to purchasers and users, that they may gain a better understanding of the possibilities and peculiarities of the internal-combustion engine and acquire more satisfaction and profit in its use. The intending purchaser is given information that will guard him against impossible claims for power and economy. The theory of the subject is carefully set forth, with the fundamental principles of its thermo-dynamics. The descriptions of typical cycles are accompanied by that wealth of illustration which is absolutely necessary to thorough instruction in any complicated device. The operation of the engine is given the space and consideration worthy of its importance. Gas and gas producers form the subject of the final chapter. The work is a very condensed and satisfactory presentation of a subject of universal interest.

MATHEMATICS FOR THE PRACTICAL MAN. By George Howe, M.E. New York: D. Van Nostrand Company, 1911. 12mo.; 143 pp. Price, $1.25 net.

The author has been impressed by the scarcity of published courses in the fundamentals of mathematics, and the tendency of these courses to treat the subject in a popular rather than a scientific way. The attendance at night schools is made up of such diverse bodies of men, of such varying degrees of training or lack of training, that instruction must always begin with studies already familiar to a large number of the students. The textbook in hand is designed to meet the requirements of night classes, in that it begins at the beginning, assumes no mathematical knowledge beyond arithmetic on the part of the student, and strives to eliminate the vagueness and diffuseness of the average elementary work. It contains the fundamentals of algebra, the first principles of trigonometry, logarithms, and the elementary principles of co-ordinate geometry and of the calculus.

LES LOIS EXPERIMENTALES DE L'AVIATION. Par M. Alexandre Sée, Ancien Elévè de l'Ecole Polytechnique. Paris: Librairie Aéronautique, 1911. 8vo.; 348 pp.; illustrated.

M. Sée's papers constitute a thoughtful and well-arranged presentation of the laws governing the science of flight. The five divisions of the work are "The Laws of Air-Resistance," "The Theory of the Aeroplane," "The Flight of Birds," "A Study of the Propeller," and "The Problem of Stability." The conclusions at which the author arrives, and the expression of these conclusions in principles and equations, occupy far too much space to be summarized here. But the work will well repay study, and should be in the library of all experimenters. It is characterized by its Parisian reviewers as a remarkably clear and complete exposition of flight and the laws by which flight is governed.

RAND-MCNALLY OFFICIAL INDEXED POCKET MAPS AND SHIPPERS' GUIDES. New York: Rand, McNally & Co., 1911. Price, 25 cents each.

We are in receipt of the following pocket maps and guides: Alberta, Colorado, Florida, Illinois, Indiana, Manitoba, Massachusetts, Mexico, Michigan, Minnesota, Newfoundland, New Jersey, New York, Ohio, Oregon, Saskatchewan, Texas, and Washington. These are detailed and very legible maps, showing the steam railroads and proposed extensions, with all stations and junctions plainly indicated. Electric roads are given in red. The new divisions and boundary lines, and the new post offices and express offices, are entered. Population, based upon the figures of the latest Census, is given for every city and village. Shippers, travelers, Civil Service students and others will continue to appreciate the cheap and handy form of this up-to-date information as they have done in the past.

ELECTROPLATING. By Henry C. Reetz. Chicago: Popular Mechanics Company, 1911. 12mo.; 99 pp.; illustrated. Price, 25 cents.

This treatise describes the process of electroplating and tells how to make a small outfit with a glass fruit jar and a wet battery. The more advanced phases of the subject are also entered, with a description of shop equipment and specific directions for nickelplating, silverplating, and goldplating, and a chapter of suggestions that may aid in establishing the beginner upon a business basis.

THE WHISTLER BOOK. A MONOGRAPH OF THE LIFE AND POSITION IN ART OF JAMES MCNEILL WHISTLER. Together with a Careful Study of his more Important Works. By Sadakichi Hartmann. Boston: L. C. Page & Co., Inc., 1910. 12mo.; 272 pp.

The art of Whistler is very much in the public eye in this country at the present time owing to the remarkable Whistler exhibition which was held last year in the Metropolitan Museum. The writer is admirably equipped to perform a most difficult task. The illustrations are admirably chosen and are beautifully executed, being printed on coated paper; the illustrations are inserted. Like all the books in this series, it is beautifully printed and bound.

WOOD-WORKING FOR AMATEUR CRAFTSMEN. By Ira S. Griffith, A.B. Chicago: Popular Mechanics Company, 1911. 12mo.; 121 pp.; illustrated. Price, 25 cents.

The student is first taught the care of tools, the laying out of rough stock, and the uses of the plane and the saw. Several simple objects are then pictured, such as a bird box, an umbrella stand, a table, a cabinet—and in taking the beginner through the details of their construction further knowledge of the handling of tools and material is easily and naturally imparted.

THE BOSTON MUSEUM OF FINE ARTS. By Julia DeWolf Addison. Boston: L. C. Page & Co., Inc., 1910. 12mo.; 454 pp.

The present work gives a descriptive and critical account of the treasures of the Boston Museum of Fine Arts, which represent the arts and crafts of remote antiquity to the present time. A work of this kind is of the greatest possible value, as it can be taken right into the gallery, where it serves as an amplified catalogue. The collections in the Boston Museum of Fine Arts are too well known to call for any praise. The collection has been admirably made and is admirably housed, particularly in the new buildings. The illustrations in the book are wisely selected and are beautifully reproduced and printed. Like all the books of this publisher, it is an excellent piece of book making and is attractively bound.

MOLDING CONCRETE CHIMNEYS, SLATE AND ROOF TILES. By A. A. Houghton. New York: The Norman W. Henley Publishing Company, 1911. 61 pp. Price, 50 cents.

This handbook is No. 4 of the series, and is explanatory of the ways in which roof tiling and chimneys are manufactured of concrete. The text is fully illustrated by original drawings, and in this, as in the other numbers of the series, a feature is made of easily constructed molds. The factor of safety has been steadily kept in mind.

MOLDING AND CURING ORNAMENTAL CONCRETE. By A. A. Houghton. New York: The Norman W. Henley Publishing Company, 1911. 58 pp. Price, 50 cents.

This, No. 5 of the "Concrete Worker's" series, tells the proper proportions of cement and aggregates for different finishes, with the methods of mixing and placing in the molds, and of curing and remedying defects in the surface finish. Also the manner of coating the molds with non-adhesive compound to prevent the concrete from sticking to the molds.

TRAIN RULE EXAMINATIONS MADE EASY. By G. E. Collingwood. New York: The Norman W. Henley Publishing Company, 1911. 18mo.; 234 pp. Price, $1.25.

PRACTICAL INSTRUCTOR AND REFERENCE BOOK FOR LOCOMOTIVE FIREMEN AND ENGINEERS. By Charles F. Lockhart. New York: The Norman W. Henley Publishing Company, 1911. 12mo.; 362 pp. Price, $1.50.

UP-TO-DATE AIR-BRAKE CATECHISM. By Robert H. Blackall. New York: The Norman W. Henley Publishing Company, 1911. 12mo.; 352 pp. Price, $2.

These three books are of the practical kind that will appeal to men who are actually engaged in railroading. Mr. Blackall's "Air-Brake Catechism," which has long been a standard work, describes the air-brake equipment and how it is operated. Mr. Lockhart's book is a text book for locomotive engineers and firemen. Mr. Collingwood's book is in the nature of a quiz, and follows the question and answer method. The three books may be recommended for giving a vast amount of information in a very compact form.

IMMUNE SERA. By Dr. Charles Frederick Bolduan. New York: John Wiley & Sons, 1911. 226 pp. Price, $1.50.

It is probably safe to say that in the scientific world there are few subjects of greater importance, as far as the great public is concerned, than that of the bacteriological treatment of diseases. The advances made in this field, particularly during the past few years, have been greater, or at least as great as, those in any other field of research. Naturally a subject which touches the well-being of the race so closely as this has provoked a widespread interest, not merely in the medical profession, but throughout every walk of life. Because of the highly scientific character of the investigations and achievements of the bacteriologist, his work is not easily explained, and is difficult of understanding, not merely by the average citizen, but even by many practitioners whose greatly occupied time prevents them from keeping in close touch with the progress which has been made. Consequently, there has been a call for a work on the subject which would be accurate, simple and concise, yet sufficiently comprehensive for a clear understanding of what has been done and of the reasonable expectations of future progress.

In the work under review, Dr. Bolduan appears to have successfully met this need. The present volume is the fourth edition of a work which first appeared in 1904, and which dealt only with certain anti-bodies, whose discovery had aroused a great deal of scientific interest. To this was added in subsequent editions a discussion of anti-toxins, agglutinins, and opsonins, all of which were naturally embraced under the title "Immune Sera." In the present edition the scope of the subject matter has been widely extended, and the work contains a clear exposition of the main facts of infection and immunity. Every one who has been sufficiently interested to read even cursorily the broader literature on this subject is familiar with the side-chain theory of Ehrlich, which of late years has dominated the investigations in this particular field. While admitting the value of Ehrlich's work, the author considers that some of the deductions from his theory have led to conclusions which seemed to violate established biological facts. Therefore, in giving a lengthy presentation of Ehrlich's views, he makes it clear just why and wherein other investigators have differed from him. Of particular interest at the present time is a chapter dealing with the principles underlying the treatment of syphilis with Salvarsan, or 606, as it is popularly called. The value of this drug is now generally conceded, and leads one to hope that further work along similar lines will sooner or later bring to light specific therapeutic agents in other diseases.

Those of our readers who have followed the newer conceptions of physical chemistry will be interested to see how quickly and extensively these have been taken up by the workers in this fascinating department of medicine.

Dr. Bolduan has succeeded in fulfilling the aim of this work, which is to present a broad, clear outline of the main facts and theories concerning infection and immunity. An excellent feature of the book is the fact that it is presented in clear, concise, and forceful English that is not overburdened with technical phraseology.

THEORIE PHYSICO-CHIMIQUE DE LA VIE ET GENERATIONS SPONTANEES. By Stéphane Leduc. Paris: A. Poinat, 1910. 8vo.; paper.

In the introduction to his remarkable book, Prof. Leduc states that the essential phenomenon of life is nutrition. If food is to be assimilated, it must be introduced in the liquid state; hence the elementary phenomenon of life is the contact between alimentary liquids and living substances, and the knowledge of life is subordinated to the knowledge of the physico-chemico phenomena which result from the contact of different liquids. Biology, in Prof. Leduc's opinion, is therefore a part of the physical chemistry of liquids. The physical chemistry of life, therefore, comprises a study of all non-electrolytic solutions and electrolytic solutions, of colloidal solutions, of the molecular forces at play in these solutions, osmotic pressure, crystallization, and the phenomena produced by such forces as diffusion and osmosis.

THE TENNESSEE SHAD. By Owen Johnson. New York: The Baker & Taylor Company. 12mo.; 310 pp.; illustrated. Price, $1.20 net.

When Owen Johnson's "The Varmint" first immortalized the American preparatory school as a few classics had immortalized the so-called "public schools" of England, not the least inspired episode was that of the Tennessee Shad's "sleep prolonger" and its exploitation by Doc Macnooder. Doc, it will be remembered, so skillfully engineered the financial end of the business as to divert to himself all the profits of the enterprise. In this later story the Tennessee Shad's imagination continues to effervesce, and the development of Macnooder's business instincts is calculated to make a pall-bearer chuckle. Johnson's handling of school themes is delicious and inimitable.

Frank Julian Sprague

(Concluded from page 363.)

Sprague developed the high-speed screw elevator, the automatic house elevator, the double motor drum elevator and other devices.

While all this was going on Mr. Sprague had offered to run the Manhattan Elevated Railway electrically, but having to deal with progressives of the type of Gould and Sage, he did not get very far. Turning his efforts to Chicago, he there put into service on the South Side Elevated his "multiple unit" system, under forfeiture contract. Once more he made good, with startling results, so that not only in Chicago, for elevated railway work, the multiple unit system is the only one known, but it is the sole dependence of the roads in New York and Boston. Then came the Manhattan Subways, and all the river tube systems—every one an example of multiple unit application.

Mr. Sprague's fundamental and basic patent on this contains nearly 300 claims, a good multiple unit in itself, and a fair exhibition of reticence on the part of a man who would rather talk and fight and invent any time than listen to music and the drama—though he dotes on both.

Of course such an inventor and engineer was early drawn into the work of changing over for electricity the big terminals of the trunk railroads; and hence he is found on the consulting staff of the New York Central. He was also retained by Harriman as to similar work on the Southern Pacific. In these developments he has been understood to stand strongly for the use of the direct current, against the alternating, as used on the New Haven road, but at the same time he has advocated hitting up the potential for direct current work, and has jumped it from 600 to 1,200 volts, with very satisfactory results. He has also been a stout advocate of the protection of the third rail, with devices exemplified on the New York Central and several other roads. More lately, Mr. Sprague has returned to the subway problem, by tongue and pen has advocated reforms and improvements, and has even offered to undertake, with full financial responsibility, the construction needed to relieve the frightful congestion on the older lines.

There is not much of Sprague to look at, but it is all fighting weight, nerve, grit, go, snap and confidence. He has crossed the 50 line, but does not suspect it; and the dark hair, flashing eye, equiline nose, sharply-cut chin, alertness of movement, tenseness of poise, all tell of a very live human being. He has an acutely mathematical mind, tempered, fortunately, by humor and imagination; but he is concentrated, and no matter what you may want to talk about, has no difficulty whatever in swinging the conversation back to the thing he is interested in. A more loyal and generous friend could not be imagined, but there are some persons he will omit from his will. To this day he maintains the keenest interest in the profession of his early years, and his appointment as visitor to the Naval Academy is still regarded by many conservatives as perhaps the saving feature of the Roosevelt administration.

Relative Strength of Italian and Turkish Navies

(Concluded from page 374.)

Of less important cruisers of the protected type Italy possesses ten, of from 2,250 to 3,500 tons, and from 17 to 20 knots speed. Their armament consists generally of from four to six 4.7-inch or 6-inch rapid fire guns. The navy includes two 23-knot torpedo cruisers and eight gunboats, the latter fitted for laying mines. The torpedo fleet is made up of twenty-three destroyers, of 28 to 30 knots speed and about 350 tons displacement. Also twelve destroyers of 620 tons and 30 knot speed are under construction. The torpedo fleet also includes eighty-one completed torpedo boats and thirty under construction. In the submarine flotilla are the "Delfino," 107 tons, 6 and 9 knots, the five "Glaucos," 150 tons, 9 and 14 knots, the "Foca," 230 tons, 9 and 15 knots, and eleven vessels under construction or about to be commenced.

At the present writing no engagements of any importance appear to have taken

place between the two navies, and it is not likely even in the event of a protracted war, that the struggle will shed much light upon the leading naval problems of construction, tactics and strategy.

Small Isolated Electric Power Plants

(Concluded from page 872.)

main battery. Each cell may consist simply of two plates of sheet lead suspended in a jar of electrolyte.

At *W* is indicated a variable resistance which must be used during the process of forming the home-made battery previously described. This will need to have a resistance of about seven ohms and a current-carrying capacity of six amperes.

When the switch, *S*, is closed to the left it connects the battery directly to the load through the upper blade. The lower switch point is not used for anything on this side, but its clip makes a most convenient place to keep a spare eight-ampere fuse. When it is desired to charge the battery the dynamo is started, and, by manipulation of the field regulator, *R*, is brought up to a voltage sufficient to light the lamp, *V*, to about half its candle-power. The switch is then thrown to the right, connecting the battery to the dynamo through the upper blade, and both battery and dynamo together to the load through the lower blade and the three c. e. m. f. cells. The charging of the battery may be done during the day or at night, as may be most convenient.

When fully charged, a 36 ampere-hour battery will run seven 16 candle-power lamps for eight hours, and it will require a current of five amperes for eight hours for the recharge. Assuming an average evening's use of four lamps for 3½ hours it should suffice to charge the battery twice a week. In winter, when the evenings are long, it may need to be charged every other day. On occasions of unusual demand, such as parties or receptions, to prevent the battery being exhausted too rapidly, it is necessary for the dynamo to be run in the evening to carry a part of the load. The same thing is true in cases where it is desired to use an electric flat-iron or vacuum cleaner, which easily can be done by keeping the dynamo going all day on "ironing day" and "cleaning day."

The foregoing specifications, as stated in the beginning, apply to a small sized installation where lighting is the principal requirement. Before installing a 32 volt plant, careful consideration should be given to the subject of future extensions. Electric cooking and other heating appliances, motors and the like not only require a larger plant to run them, but it is desirable to operate them at a higher voltage in order to keep down the size of the copper conductors necessary to carry the large currents imposed by low voltage. For larger plants sixty volts has been adopted as a standard, and makers of lamps, heating appliances, etc., now carry these in stock made for this voltage. The following specifications will give a good idea of what is needed for a 60 volt plant:

Battery, 30 cells two-plate type 36 ampere-hours capacity and 6 c. e. m. f. cells, or 60 cells of the home-made battery, connected thirty in series and two in multiple, with 6 c. e. m. f. cells all in series.

Generator, shunt wound dynamo 77 volts, 5 amperes, speed about 2,000 r. p. m.

Engine, one horse-power.

Ammeter, 10-0-10 scale; voltmeter, 80 volt scale.

This outfit will have twice the capacity of the one previously described. It would be suitable for a connected load of forty 16 c. p. lamps where the maximum demand is limited to twenty-five. The battery alone will be large enough to handle light intermittent loads through the day, such as coffee-percolater, electric toaster, or a one-half horse-power pump motor for the house tank supply. This outfit is adapted for future enlargement by the addition of more battery, but if this is anticipated in the very beginning it would be better to install a larger charging equipment—say a 2 horse-power engine with a 77 volt 10 ampere dynamo, and to have the ammeter scale marked 20-0-20.

The Electrical Show in the New Grand Central Palace

THE New York Electrical Show, this year, was used to open the new Grand Central Palace, located on Lexington Avenue, between 46th and 47th streets. This handsome structure was brilliant with myriads of electric lights, which were reflected with great brilliancy by the white walls of the interior. At the top of the building on the outside the arched gallery was illuminated with mercury vapor lamps, the bluish light of which gave a soft, delicate effect when viewed from a distance in the light of the full hunter's moon.

Several of the large electric companies have excellent exhibits of all kinds of household electrical apparatus. Along the south side of the building there is a row of rooms illustrating the equipment of a modern house from kitchen to bedroom. In the former room there is an electrical washer, a churn, a chopping machine, and a full equipment of cooking utensils, while in the bedroom there is an electric massage instrument, a miniature hair-drying fan, an electrically-operated sewing machine, etc. The company also has a complete electrically-operated printing plant along the west side of the building. A small paper is printed every day, giving the latest news, many of the despatches being received by wireless.

A particularly interesting display was the historical exhibit in the gallery. This consisted of old books dating back to the time of Franklin, and various electrical apparatus. The most interesting feature, perhaps, of this exhibit was the development of the arc lamps, from the original Brush twin-carbon lamp, to the flaming-arc lamp of the present day.

Storage batteries and electric automobiles occupy a considerable part of the floor space, there being exhibits by the Edison, Exide, and Gould storage battery firms, as well as electric automobiles of most of the leading makes. The recent record of 110.9 miles made on the Ocean Boulevard between Brooklyn and Coney Island by a Fritchle electric car carrying four people, which was made with a lead battery, has been exceeded under actual touring conditions by the Edison battery, which, about a year ago, received a thorough testing under Edison's supervision, in pleasure vehicles. Some time after, a run of 244½ miles at the rate of 12 miles an hour, was made with a Baker electric auto on city streets in Cleveland, with a 40-cell 225-ampere-hour Edison battery. This is the record for tests of the kind just mentioned, while for touring purposes, from 125 to 150 miles, it is claimed, can be made on one charge. Plates taken from a cell which has been in continuous use in delivery service in New York city for two and one-third years, and which has run a delivery wagon 25,000 miles, were exhibited and showed no depreciation. The capacity of these cells is said to have risen from 225 to 300 ampere hours after this long-continued use. In addition to this increase of capacity with use, the Edison battery has the advantage that it can be charged whenever convenient, and is not ruined if left standing in a discharged condition. The Electric Storage Battery Company also exhibited vehicles and stationary cells.

A barber shop equipped with all the latest electrical appliances, was located in the middle of the main floor, while on a raised platform above there was exhibited a novel combined electric piano and violin orchestra. Three violins were mounted upside down in a circle above the piano, and were played by means of a revolving ring, rotated at various speeds in producing the different notes. Whenever a note was struck on a violin, the instrument was moved about its neck as a pivot until the strings contacted with the ring. Meanwhile, electrically-operated levers fingered the strings. The music produced by this orchestra was excellent nd the amount of expression secured was surprising.

As a whole, the show this year is made up of small apparatus. There are none of the big motors and generating sets that have sometimes been exhibited when the show was held in Madison Square

Garden. The myriad uses of electricity in the home and office, however, have never been so well illustrated as now, and this alone, together with the historical exhibit, makes the show interesting to laymen.

The Glidden Tour and the Fairmount Park Automobile Race

MORE than fourscore automobiles started in the 1911 Glidden tour from New York city on October 14th. The route this year extends 1,456 miles from New York to Jacksonville, Florida. The trophy will be contested for by teams, the team having the best average of prompt arrivals being the winner. There are various divisions for runabouts and touring cars, besides which there are several three-wheeled motorettes and a number of trucks and baggage cars. It is expected that the 1911 tour will be the most successful of any held thus far, as the roads of the South have been greatly improved during the last few years, which should assure the motorists an enjoyable trip.

On October 9th, there was held in Fairmount Park, Philadelphia, the automobile race for fast cars, that has been run annually for the past several years. This race was notable for the fact that there were no accidents of any sort, and yet the speed records were broken, principally by amateur drivers. The winner of the race was Erwin Bergdoll, in a 90-horse-power Benz. His time was 3:18:41.35—an average of 61.25 miles an hour. He beat by 10 minutes 26.53 seconds the time of Zengel, in a Chadwick car last year. In fact, no less than six of the nine cars that finished this 202½-mile race, beat the time of the winner last year, which was 3:39:07.88. Spencer Wishhart, in a Mercedes, secured second place in 3:20:11.42. He held the lead for three laps, but was finally outdistanced. Ralph Mulford, in a Lozier, obtained third place. His time was 3:21:52.78. He stood a good chance of coming in second, but was obliged to stop for gasoline and oil near the end of the race, and in so doing lost his position. Last year Mulford finished but six seconds behind the winner.

Mr. Bergdoll beat the best record for one lap no less than six times, besides equaling it once during the race. The time of 7:36 for the 8.1-mile lap, made by Harround in a Marmon car last year, was reduced to 7 minutes and 28 seconds by this amateur racing driver. Several other well-known automobile racing men finished in the remaining places. Zengel, in a National, was fourth, and Disbrow, also in a National, was fifth, while Harry F. Grant, twice the winner of the Vanderbilt cup race, was sixth. A small car, the Mercer, obtained seventh place in 3:29:45½. This race was particularly interesting from the fact that the first and second places were won by amateurs. The next big race of this kind will be held at Santa Monica, Cal., shortly.

Repairing Old Bridges by Injecting Cement

AT Hamburg there are two bridges the masonry of which was threatening to fall in ruins, being traversed by innumerable cracks of varying size. A rather remarkable process has just been made use of to rejuvenate these bridges. A number of holes were bored throughout the structure so as to give access to the interior, and cement was injected by pumps under pressure. Reports on the present condition of the two bridges thus treated are entirely favorable.—*La Nature.*

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Harvest Moon

To the Editor of SCIENTIFIC AMERICAN:

I beg to call your attention to Fig. 7, illustrating my recent article, "The Harvest Moon." My drawing showed the illuminated hemisphere on the left. Of course, I see how it happened, but it is misleading. FREDERIC R. HONEY.

Hartford, Conn.

INVENTORS' NUMBER

NOVEMBER MAGAZINE NUMBER of the SCIENTIFIC AMERICAN

ISSUE OF NOVEMBER 18th, 1911

Although every number of the Scientific American discusses the inventions and inventors of the day, there will be published on November 18th a mid-month magazine number which will display the inventor in a new light. Articles will be published which will show how much he suffers from our antiquated legal system and will explain his need of sympathetic governmental support. His foibles, too, will not escape notice.

There will be an arraignment by Mr. Melville Church of our marvelously complicated method of trying patent infringement suits. Mr. Church is one of the most eminent patent lawyers in this country, a man who has figured prominently in some of the most important patent cases that have been tried in this country. He points out what a burden is imposed by the present method of taking testimony in chambers without any Court supervision and how enormously expensive a trial may be before the infringer is successfully brought to book. We need only mention the scores of volumes of printed testimony taken during the trial involving the validity of the Selden patents, to drive home the utter absurdity of our Court procedure. The inventor who has suffered because of the slowness of our judicial machinery will read Mr. Church's article with interest and profit, for he will learn what steps are being taken to protect without impoverishing him.

The great industrial corporation (the "Trust" of whom we have been hearing so much of late) has changed the aspect of invention. It now pays to invent thousands of little feeding devices, thousands of little trains of gears and levers and cams, which, fifty years ago, might not have proved so profitable. An invention that means a saving of one cent per ton in the handling of raw material becomes of industrial importance for the simple reason that the "Trust" deals in gigantic masses. In an article entitled "The Industrial Corporation and the Inventor" this aspect of modern invention is treated.

Fascinating is the story of making big fortunes out of patents on small and apparently unimportant things. Every time anybody in the United States pulls the cap off a beer bottle or a soda water bottle, he puts the fraction of a cent into the pockets of a Baltimore inventor. Elias Howe, who first made the sewing machine practical by placing the eye of the needle near the point, admitted that he had collected $1,185,000 in royalties. The man who invented ingrain carpet with the threads so interwoven as to prevent wrinkling, is now better off by $4,000,000 for his thought. A government clerk named McGill found it hard to hold together many pages of thick documents. He got over the difficulty by inventing the little brass paper fasteners which we all use. He died rich. His invention made money. These are but a few of the facts taken from a striking article by Mr. William Atherton DuPuy on the big fortunes that have been made on little inventions.

Perpetual motion is the inventor's Will-o'-the-Wisp. In the Inventors' number will be found an article in which the various forms of perpetual motion apparatus that have engaged the attention of dreamers for years are explained and their fallacies set forth.

There is a funny side to invention as the Inventors' Number will tell you. What possible use could there be in encouraging birds to infest the farmer's grain fields by providing fence posts with birds' nests in them? Or of table knives with mirrors in the handles to permit the users to inspect their teeth now and then? Or of a telescopic anti-collision pilot for railway trains running in advance of the locomotive and bearing an automaton that rings a loud gong? These and even more ridiculous inventions will be described in the article on "The Funny Side of Invention."

In addition to these articles, there will be the usual Scientific American material—the articles on current scientific discoveries, the Department of Curiosities of Science, the Science Abstracts and the rest.

Price Fifteen Cents On All News Stands